DOCUMENT RESUME

ED 022 525 52 LI 001 031

ON THE ECONOMICS OF LIBRARY OPERATION. FINAL REPORT SUBMITTED TO NATIONAL ADVISORY COMMISSION ON LIBRARIES.

Mathematica, Princeton, N.J.; National Advisory Commission on Libraries, Washington, D.C.
Spons Agency-Office of Education (DHEW), Washington, D.C. Bureau of Research.
Bureau No-BR-7-0961
Pub Date 30 Jun 67
Contract-OEC-2-7-010105-1523
Note-168p.
EDRS Price MF-$0.75 HC-$6.80
Descriptors-AUTOMATION, CAPITAL OUTLAY (FOR FIXED ASSETS), *COSTS, *ECONOMICS, *FINANCIAL SUPPORT, LIBRARIANS, *LIBRARIES, *LIBRARY EXPENDITURES, LIBRARY MATERIALS, LIBRARY SERVICES, MATHEMATICAL MODELS, OPERATING EXPENSES, PUBLIC SUPPORT, SALARIES, STATE FEDERAL SUPPORT, STATISTICAL ANALYSIS

Both an analysis of the sources of cost trends in libraries and the relationship of the prospective role of automation in library operations to the causes of cost trends and the predicted shortage of trained librarians are examined in the study of the economic structure of the library. Issues investigated are those particularly relating to current and prospective policies: considerations relating to automation, the prospects for funding from various sources, the compensation of librarians, the role of economics of size, and the nature of library costs. As libraries are presently operated, cumulatively rising relative costs per unit of service are an unavoidable consequence. Although this can be offset to some extent by automation, it also means that as the economy's wealth grows, the financial needs of the library will also increase. Appendices to the report describe an economic-mathematical model of library operations and give an application of the model for public library data from 1954 to 1959. (Author/CM)

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ERIC/CLIS
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UNIVERSITY OF MINNESO

ON THE ECONOMICS
OF
LIBRARY OPERATION

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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FINAL REPORT

Submitted to

NATIONAL ADVISORY COMMISSION ON LIBRARIES

June 30, 1967

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ON THE ECONOMICS OF LIBRARY OPERATION

Part I. Introduction

Libraries are currently beset by the effects of a number of developments which complicate their operation and require re-examination of some of their procedures. Above all, these developments have important implications concerning the nature of the financial problems which libraries must face in the future.

It is easy to list some of the phenomena in question:

1. The " explosion of knowledge" has greatly increased the rate of publication of books and, therefore, has added substantially to the number of volumes a given library must be prepared to carry if it is to continue, in some sense, to offer the same level of service as in the past.

2. A variety of innovations in technology, many of them related to the electronic computer and automation, have recently become available, and more are in prospect in the relatively near future. Librarians feel themselves under some obligation to examine the new alternatives which are opened for them by these innovations and to determine which, if any, will

permit an improvement in the level of service they offer or enable them to reduce costs without any significant reductions of the utility of the library to those using its facilities.

3. The present and prospective shortage of librarians threatens to curtail the operations of the libraries and causes some concern about the services they can offer in the future to scholars and readers.

4. Increasing costs of operation are a source of financial pressure which constantly give rise to a need for greater funds. This in turn adds to the financial pressures which already beset the universities, the school boards, the municipalities and the other sources of financing of the libraries.

This report has set itself several objectives in relation to the developments which have been noted:

Foremost, it seeks to supply an analysis of the sources of the cost trends which color the entire financial circumstances of our libraries and can have such important consequences for their operations. In this discussion, it will be shown that the rate of cost increase is perhaps greater than had generally been recognized and that there is no reason to expect this to diminish in the future. It will also be demonstrated that these rises in costs would have occurred even in the absence of the "knowledge explosion." The reasons for the trends in cost will be shown to arise not out of any inefficiencies in library operation but out of the very nature of their technology , the manner in which their product (service) must be produced.

We will also examine the prospective role of automation in library operations. This will be seen to relate directly to the causes of the cost trends which have just been mentioned, as well as the predicted shortage of trained librarians.

Thus, all of the developments described at the beginning of this section will be seen to mesh, and together they will be shown to serve as portents of the future financial needs of our libraries and to act as a basis for a prescription of efficient modes of library operation in the future.

In reading this report, the haste with which it had to be prepared should constantly be kept in mind. Approximately three months were made available for a study that should normally occupy one or two years. Consequently, we were forced to rely on data which were already available before the report was undertaken. While we had initially been prepared to undertake some primary data collection on the basis of a restricted sample, in the event this proved unavoidable, early in the course of the investigation it appeared that the available statistics, while imperfect and sometimes highly limited, would be ample for our purposes. Only toward the end of our work did it develop that there were serious errors in many of the figures and that they had been constructed in a manner which rendered many of them unusable.[1] It was then far too late to embark on any process of primary data collection. Had our assignment been the production of a compendium of reliable library statistics, this development would surely have proved fatal for the study.

Happily, our task was primarily analytical in nature and for that the available data were sufficient, though, of course, further figures which could have provided additional confirmation of the results would have been highly desirable.

The preceding remarks are not intended in any way to constitute an apology for what has been accomplished. The results speak for themselves and we believe they provide a variety of important insights into the economics of library operation which were previously unavailable. However, the gaps in the supporting data should not go unexplained; one must give the reasons why we are unable to provide individual sets of information for the many different classes of library: public libraries, university libraries, elementary school libraries, etc. In any event, as will be seen , the fundamental analysis and its policy implications are equally applicable to all of these classes of institution (or rather, the variation in applicability is a relatively minor matter of degree). As a result, the absence of separate time series for each category of institution is, for our purposes, no serious loss.

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[1] Many of our time series were completely discredited when we were informed, three weeks before the completion of the study, that the statistics were averages in which any cost figures that had not been reported were taken to be zero ! Thus, a year in which a large number of libraries failed to report would be shown as a year of exceptionally low costs.

Part II. Library Costs: General Discussion

1. Breakdown of Costs

In discussing library costs it is convenient to break them into two major categories: capital (construction) costs and operating costs. The former are subject to much greater variation than the latter because building programs can usually be postponed and so their timing is highly dependent on the availability of funds.

In 1959 public libraries serving communities of 50,000 or more incurred operating costs of some 125 million dollars. Their capital outlays amounted to about 17.5 million dollars or about one seventh the costs of operation (See Table 1). In the same year (or rather, fiscal 1960) the operating costs of college and university libraries in the United States amounted to about 137 million dollars (See Table 4). We have no corresponding figures on their capital outlays. Public school libraries in schools with 150 pupils or more are estimated to have incurred operating costs of 210 million dollars in 1960-61.

The available data on library costs are presented in Table 1 (public libraries, 1954-59), Table 3 (our sample of 100 college and university libraries, 1951-66) and Table 4 (figures for all college and university libraries, 1960-66).

The libraries' operating costs consist largely of two categories of outlay: staff salaries and book purchases (which might for some purposes also be interpreted as a capital expenditure). For example, (See figure 1) of the $125 million of public library expenditures in 1959, $90 million or slightly more than 70 percent consisted of salaries and wages.

TABLE 1

Public Libraries Serving Cities with a Population of 50,000 or More[3]

	1950	1951	1952	1953	1954
POPULATION SERVED			55,870,000	55,940,000	56,327,000
Public libraries reporting					227
STAFF POSITIONS					
Total positions all staff					20,366
Professional positions					7,555
COLLECTION AND CIRCULATION (in volumes)					
Total at end of year	61,200,000	Data Does Not Exist	64,800,000	66,400,000	68,459,000
Volumes added during year					4,982,006
Total circulation	182,400,000		189,400,000	191,900,000	205,267,000
Juvenile circulation					89,463,000
Per capita circulation					
OPERATING EXPENDITURES					
Total	65,790,000		78,830,000	86,400,000	90,118,000
Salaries and wages (including building staff)			55,070,000	60,360,000	65,060,000
Books and periodicals			10,190,000	11,130,000	11,610,000
Other printed material					
Audiovisual					
Binding					
Other					

TABLE 1 (Continued)

	1955	1956	1957	1958	1959
POPULATION SERVED	56,191,000	56,708,000	56,651,000	56,704,000	57,010,000
Public libraries reporting	227	227	227	227	228
STAFF POSITIONS					
Total positions all staff				22,402	23,648
Professional positions				7,654	7,684
COLLECTION AND CIRCULATION (in volumes)					
Total at end of year	70,109,000	71,600,000	73,757,000	76,350,000	78,595,000
Volumes added during year	5,159,000	5,558,000	5,571,000	5,769,000	6,084,000
Total circulation	214,484,000	223,631,000	233,722,000	251,536,000	261,601,000
Juvenile circulation	95,932,000	95,715,000	101,611,000	110,108,000	
Per capita circulation					
OPERATING EXPENDITURES					
Total	95,613,000	103,260,000	110,665,000	118,730,000	125,929,000
Salaries and wages (including building staff)	69,173,000	74,017,000	79,998,000	85,130,000	90,129,000
Books and periodicals	12,496,000	13,099,000	13,984,000	14,674,000	16,070,000
Other printed material					
Audiovisual			481,000	489,000	567,000
Binding				2,398,000	2,450,000
Other				16,039,000	16,712,000
					17,549,000

Source: Public Library data was obtained from the following series:

U.S. Department of Health, Education and Welfare, Office of Education, *Statistics of Public Library Systems in Cities with Populations of 100,000 or more*. Annual

U.S. Department of Health, Education and Welfare, Office of Education, *Statistics of Public Library Systems in Cities with Populations of 50,000 to 99,999*. Annual

(*Fiscal 1958* was not published as a separate circular, however the relevant data did appear in the 1959 circular).

[3] The New York Reference Library is not included in this public library data.

TABLE 2

Relative Sizes of Different Types of Libraries

	No. of Libraries	No. of Vol. Owned	No. of Vol. Circulated	No. of Registered Borrowers	Operating Expenditures (excluding capital outlay)
College and University Libraries (1966)	2,207	265,000,000		5,900,000	$320,000,000
College and University Libraries (1962)	1,985	201,423,000		3,900,000	183,900,000
Public Libraries (1962)[4]	864	163,000,000	524,000,000		253,000,000
Public School Libraries (1961)					
Total All	102,500			35,952,000	210,000,000[5]
With centralized libraries	47,500	143,540,000		25,300,000	

[4] Figures are for Public Libraries (for city, county and regional and including the New York Reference Library) serving populations of 35,000 or more.

The total number of Public Libraries in the U.S. (for 1962) serving all population group is approximately 7300 with almost half serving populations of less than 3000.

[5] For public school districts enrolling 150 pupils and over:

Sources: a) American Library Association, Library Statistics of Colleges and Universities, 1965-66, Institutional Data, pp. 6-9.

b) For Public Libraries see footnote to Table 1.

c) For Public School Libraries see: U.S. Department of Health, Education and Welfare, Office of Education. Statistics of Public School Libraries, 1960-61.

TABLE 3[6 and 7]

Sample of Libraries of Institutions of Higher Learning

	1951	1952	1953	1954	1955	1956	1957
Undergraduates	460,000	370,000	320,000	350,000	425,000	490,000	515,000
Graduate Students	118,500	90,000	72,000	73,000	85,000	93,000	99,000
(Total Enrollment)	579,000	460,000	390,000	420,000	510,000	585,000	615,000
Book Stock	40,020,000	33,930,000	31,855,000	35,825,000	43,610,000	46,990,000	49,000,00
Volumes Added	1,620,000	1,400,000	1,280,000	1,435,000	1,680,000	1,800,000	1,790,000
Total Full-time Employee Equivalent	4,225	3,630	3,175	3,400	4,050	4,385	4,570
Student Hours	2,545,000	2,195,000	1,775,000	2,290,000	2,450,000	2,580,000	2,685,000
Total Institutional Expenditures		527,675,000	455,035,000	519,480,000	637,295,000	754,100,000	826,730,000
Total Operating Cost	20,080,000	18,865,000	17,565,000	19,980,000	24,070,000	27,180,000	29,570,000
Staff Salaries	10,380,000	10,280,000	9,685,000	10,205,000	13,290,000	14,990,000	16,085,000
Student Pay	1,810,000	1,600,000	1,345,000	1,570,000	2,085,000	2,390,000	2,795,000
Book Purchases	3,965,000	3,590,000	3,720,000	4,855,000	5,785,000	6,695,000	7,240,000
No. in Sample	97	81	75	78	88	100	100

Source: The College and University Library sample for fiscal 1951 through fiscal 1959 was taken from: American Library Association, Statistics Committee of the Association of College and Research Libraries, College and Research Libraries. January issue, Annual series.

From fiscal 1960 to 1964 our data was extracted from the continuation of this statistical compilation by: U.S. Department of Health, Education and Welfare, Office of Education, Library Statistics of Colleges and Universities, Part 1: Institutional Data, Annual

In 1966 the American Library Association assumed responsibility for the series, and published in 1967: Library Statistics of Colleges and Universities 1965-66 Institutional Data.

[6] For details on the construction of the sample see Appendix C.

[7] Since this table reports figures only for a sample of libraries, the absolute totals are not of any particular significance. Only trends, cost proportions and unit cost figures can validly be deduced from these statistics.

TABLE 3

(Continued)

Sample of Libraries of Institutions of Higher Learning

	1958	1959	1960	1961	1962	1963	1964
Undergraduates	510,000	510,000	595,000				
Graduate Students	100,000	110,000	135,000				
(Total Enrollment)	615,000	620,000	730,000	775,000	830,000	890,000	930,000
Book Stock	49,680,000	52,390,000	54,925,000	58,195,000	60,745,000	64,170,000	65,975,000
Volumes Added	1,950,000	2,080,000	2,190,000	2,500,000	2,820,000	3,065,000	3,265,000
Total Full-time Employee Equivalent	4,745	5,120	5,275	5,625	6,100	6,570	
Student Hours	2,685,000	2,800,000	2,900,000	3,350,000	3,415,000	3,640,000	3,685,000
Total Institutional Expenditures	927,070,000	1,108,145,000					
Total Operating Cost	34,080,000	37,680,000	41,295,000	50,305,000	52,980,000	60,115,000	68,005,000
Staff Salaries	18,290,000	20,250,000	22,310,000	24,815,000	27,805,000	31,370,000	34,725,000
Student Pay	2,990,000	3,331,000	3,670,000	4,190,000	4,486,000	4,740,000	5,085,000
Book Purchases	9,170,000	9,930,000	11,170,000	14,190,000	15,440,000	18,455,000	20,365,000
No. in Sample	100	100	100	100	100	100	100

TABLE 3
(Continued)

	1965	1966
Undergraduates	Does Not Exist	
Graduate Students (Total Enrollment)		1,020,000
Book Stock		72,050,000
Volumes Added		4,370,000
Total Full-time Employee Equivalent		8,165
Student Hours		4,390,000
Total Institutional Expenditures		
Total Operating Cost		88,260,000
Staff Salaries		44,135,000
Student Pay		6,640,000
Book Purchases		27,860,000
No. in Sample		100

TABLE 4 -- SUMMARY OF COLLEGE AND UNIVERSITY

AGGREGATE UNITED STATES

ITEM	1959-60	1960-61	1961-62
1. Number of libraries........	1,951	1,975	1,985
2. Number of students served (enrollment)..............	3,402,000	3,610,000	3,900,000
COLLECTIONS			
3. Number of volumes at end of year................	176,721,000	189,110,000	201,423,000
4. Number of volumes per student................	51.9	52.4	51.6
5. Number of volumes added during year..........	8,415,000	9,396,000	10,900,000
6. Number of volumes added per student..........	2.5	2.6	2.8
7. Number of periodicals received....................	1,271,000	1,399,000	1,505,000
8. Number of periodicals per student................	0.4	0.4	0.4
PERSONNEL			
9. Total (in full-time equivalents)...............	18,000	19,500	21,100
10. Professional personnel.....	9,000	9,700	10,300
11. Professional staff as percentage of total staff..	0.50	0.50	0.49
12. Ratio of professional staff to students................	1:378	1:372	1:378
13. Nonprofessional staff......	9,000	9,800	10,800
14. Number of hours of student assistance.........	12,062,000	13,204,000	14,161,000

LIBRARY STATISTICS FOR ACADEMIC YEARS 1959-65:

1962-63	1963-64	1964-65	1966*
2,075	2,140	2,168	2,207
4,345,000	4,800,000	5,300,000	5,900,000
215,000,000	227,000,000	241,000,000	265,000,000 (includes microtext)
49.4	47.3	45.5	45.8
12,300,000	13,600,000	14,000,000	18,000,000
2.8	2.8	2.6	3.0
1,600,000	1,760,000	1,800,000	2,700,000**
0.4	0.4	0.3	0.4
23,300	25,200	27,000	29,000
11,200	11,900	12,500	13,000
0.48	0.47	0.46	0.45
1:388	1:401	1:402	1:454
12,100	13,300	14,500	16,000
14,519,000	16,400,000	18,000,000	19,000,000

TABLE 4 -- SUMMARY OF COLLEGE AND UNIVERSITY

AGGREGATE UNITED STATES

ITEM	1959-60	1960-61	1961-62
OPERATING EXPENDITURES			
15. Total (excludes capital outlay)....................	$137,245,000	$158,904,000	$183,700,000
16. Expenditures per student...	$40.34	$44.02	$47.13
17. Expenditures as percentage of total education and general expenditures.......	3.0	3.1	3.1
18. Salaries (personnel not on hourly rate)............	$72,495,000	$83,782,000	$95,900,000
19. Salaries as percentage of operating expenditures.....	52.8	52.7	52.2
20. Wages (at hourly rates of pay)......................	$11,680,000	$13,889,000	$15,500,000
21. Wages as percentage of operating expenditures.....	8.5	8.7	8.5
22. Books and other library materials expenditures.....	$40,760,000	$48,301,000	$56,400,000
23. Such expenditures percentage of operating expenditures..	29.7	30.4	30.7
24. Binding expenditures.......	$4,852,000	$5,000,000	$6,200,000
25. Such expenditures percentage of operating expenditures..	3.6	3.2	3.4
26. Other operating expenditures...............	$7,458,000	$7,932,000	$9,700,000
27. Such expenditures percentage of operating expenditures..	5.4	5.0	5.3

Source: U.S. Office of Education, Library Statistics of Colleges Compiled by Theodore Samore.

* Estimated.

** For 1965-66, the figures are for serials which includes, periodicals, LIBRARY STATISTICS FOR ACADEMIC YEARS 1959-65:

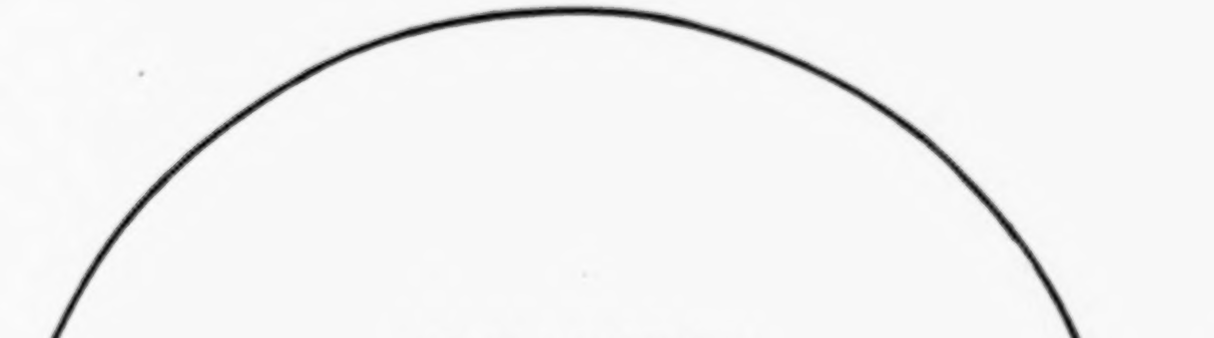
1962-63	1963-64	1964-65	1966*
$213,000,000	$246,000,000	$275,000,000	$320,000,000
$50.95	$51.25	$51.89	$54.23
3.2	3.3	3.3	3.3
$113,000,000	$126,000,000	$138,000,000	$155,000,000
53.1	51.2	50.2	49.0
$17,000,000	$19,000,000	$21,000,000	$23,500,000
8.0	7.7	7.6	7.3
$65,000,000	$79,000,000	$91,000,000	$111,000,000
30.5	32.1	33.1	34.2
$7,000,000	$9,000,000	$11,000,000	
3.3	3.7	4.0	3.5
$11,000,000	$13,000,000	$14,000,000	$19,000,000
4.2	5.3	5.1	6.0

and Universities, 1959/60-1964/65. Institutional Data.

annuals, proceedings, transactions, etc.

Figure 1

Breakdown of Operating Expenses for Public Libraries in Cities with Populations of 50,000 or More for 1959



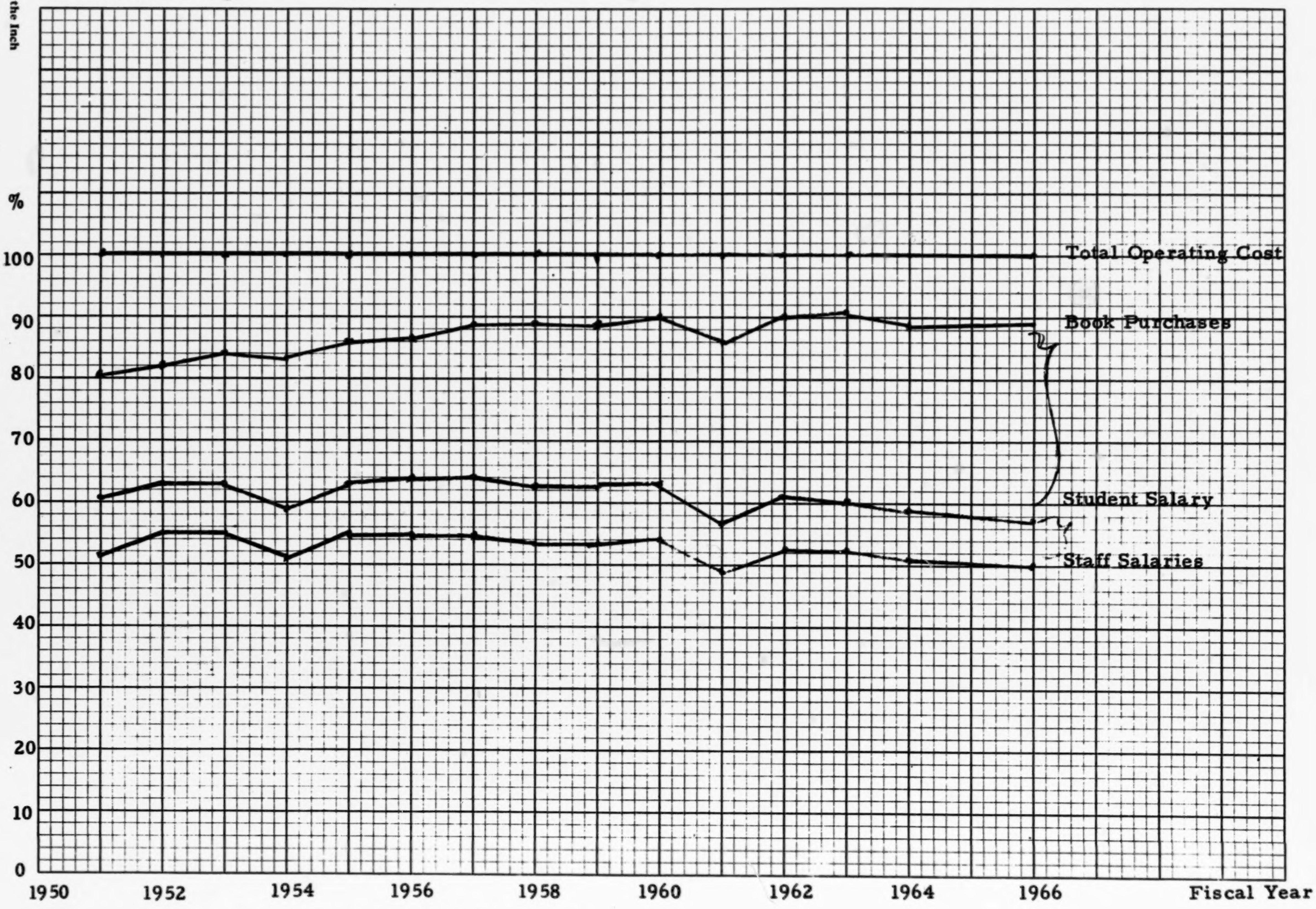
Note: Details do not add to 100.0% because of rounding.
Source: See footnote to Table 1.

$15 million or about 12 percent was devoted to the purchase of books and about $1 million for periodicals. No other categories of expenditure amount to over $600,000 for the entire country!

In the college and university libraries, our latest figures, those for 1966, show that of a total operating expenditure of $88 million by libraries in our sample, $44 million or 50 percent went to staff salaries, $6.6 million or 7.5 percent was devoted to payment for student assistance, and $28 million or somewhat more than 30 percent was expended on book purchases. Looking at the trends over time we see that there has been some slight tendency for a relative decline in the proportion of current operating expenditure that is made up of staff salaries. In the decade of the fifties professional salaries constituted about 54 percent of the total operating costs, while during the sixties this figure has declined fairly steadily toward its 1967 value of 50 percent. Meanwhile the relative magnitude of expenditures in new books has been growing from a little less than twenty percent of the total in 1951 to its present thirty percent. All of this is illustrated in figure 2, which shows the course of the percentage breakdown of the major categories of operating expenditure for our sample of

Institutions of Higher Learning

Figure 2
Percentage Breakdown for Total Library Operating Expenditures



Source: See footnote to Table 3

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TABLE 5[7]

Institutions of Higher Learning

Percentage Breakdown for Total Library Operating Expenditures

	Staff Salaries	Student Pay	Book Purchases
1951	51.7	9.0	19.8
1952	54.5	8.5	19.0
1953	55.1	7.7	21.2
1954	51.1	7.9	24.3
1955	55.2	8.7	24.0
1956	55.2	8.8	24.6
1957	54.4	9.5	24.5
1958	53.7	8.8	26.9
1959	53.7	8.8	26.4
1960	54.0	8.9	27.0
1961	49.3	8.3	28.2
1962	52.5	8.5	29.1
1963	52.2	7.9	30.7
1964	51.1	7.5	30.0
1966	50.0	7.5	31.6

---

[7] See footnote to Table 2

college and university libraries.[8/9]

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[8] Most of our discussion of costs in college and university libraries is based on our carefully constructed sample consisting, for the most part, of 100 institutions of higher education, selected from among universities, liberal arts colleges, junior colleges and teachers colleges. In general, the sample seems very representative for the first two categories of institution. For details on the construction of the sample see Appendix C.

[9] It will be noted that our analysis has attempted no breakdown of costs on the basis of library function, i.e., in terms of acquisition, cataloguing, circulation, reference, etc. Obviously, we have not provided these data in part because the figures are simply unavailable. But there is a more fundamental reason which indicated that the data are unlikely to become available even if substantial effort is devoted to their acquisition. The librarian's work involves his going frequently from task to task and without elaborate records indicating hour by hour (and perhaps sometimes minute by minute) how he spends his time, one could not hope to get the information required. Moreover, some library costs are joint costs which are inherently inseparable; lighting serves those who use the catalogue and those who browse through nearby shelves. It is literally impossible to decide how much of the lighting cost should be assigned to each of these functions. In industry, attempts to obtain cost breakdown of the sort under discussion have produced figures that are highly questionable and arbitrary, and which have been criticized by many economists.

In any event, it is difficult to see any important use to which such data can be put. If it were possible to show, for example, that circulation costs were surprisingly low relative to the cost per reference use, what modification in library operations would consequently recommend itself?

2. Capital Costs of Public Libraries

A small amount of information is available on capital needs of public libraries, mostly from the 1966 Report on State and Local Public Library Facility Needs, by Nathan Cohen of the Office of Education.[10] The following data on the age distribution of library facilities are taken from the Survey of Public Library Building Facilities, 1963-64, reproduced in the 1966 Report on Needs.

Table 6

Age of Publicly Owned Library Buildings

Construction Period	% of All Buildings
Before 1905	16
1905-1924	22
1925-1960	48
1961 or later	14
	100

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[10] State and Local Public Facility Needs and Financing, Vol. I, Public Facility Needs, Joint Economic Committee, USGPO, Dec. 1966, Chapter 36.

These publicly owned buildings accounted for 89.4% of the estimated 56.5 million square feet of space occupied for public library purposes in 1965. The estimated replacement value of publicly owned facilities, including costs of land, site development, fees, and initial equipment, was $1,262.5 million in 1965. This figure was apparently arrived at by using estimated costs of new library facilities of $25 per square foot. Additions were estimated to cost $20 per square foot, while remodeling averaged only $8 per square foot in 1965. These estimates were based on sample construction costs on projects completed in 1965.

The following table summarizes estimates of capital outlays for public library facilities derived from reports to the Office of Education in its periodic surveys. The Federal component in 1965 represents expenditures under the Federal Library Services and Construction Act.

Table 7

Capital Outlays of Public Libraries

(Million $)	Total	Local	State	Federal	Other e
1965	103.0	70.9 e	0.5	29.9	1.7
1964	61.3	60.1	--	--	1.2
1962	27.7	26.8	--	--	.9
1956	12.3	11.7	--	--	.6
1950	4.4	4.1	--	--	.3
1946	1.8	1.6 e	--	--	.2
1945	1.2	1.0	--	--	.2

e - estimated or extrapolated

Source: State and Local Public Facility Needs, Vol. I, p. 623.

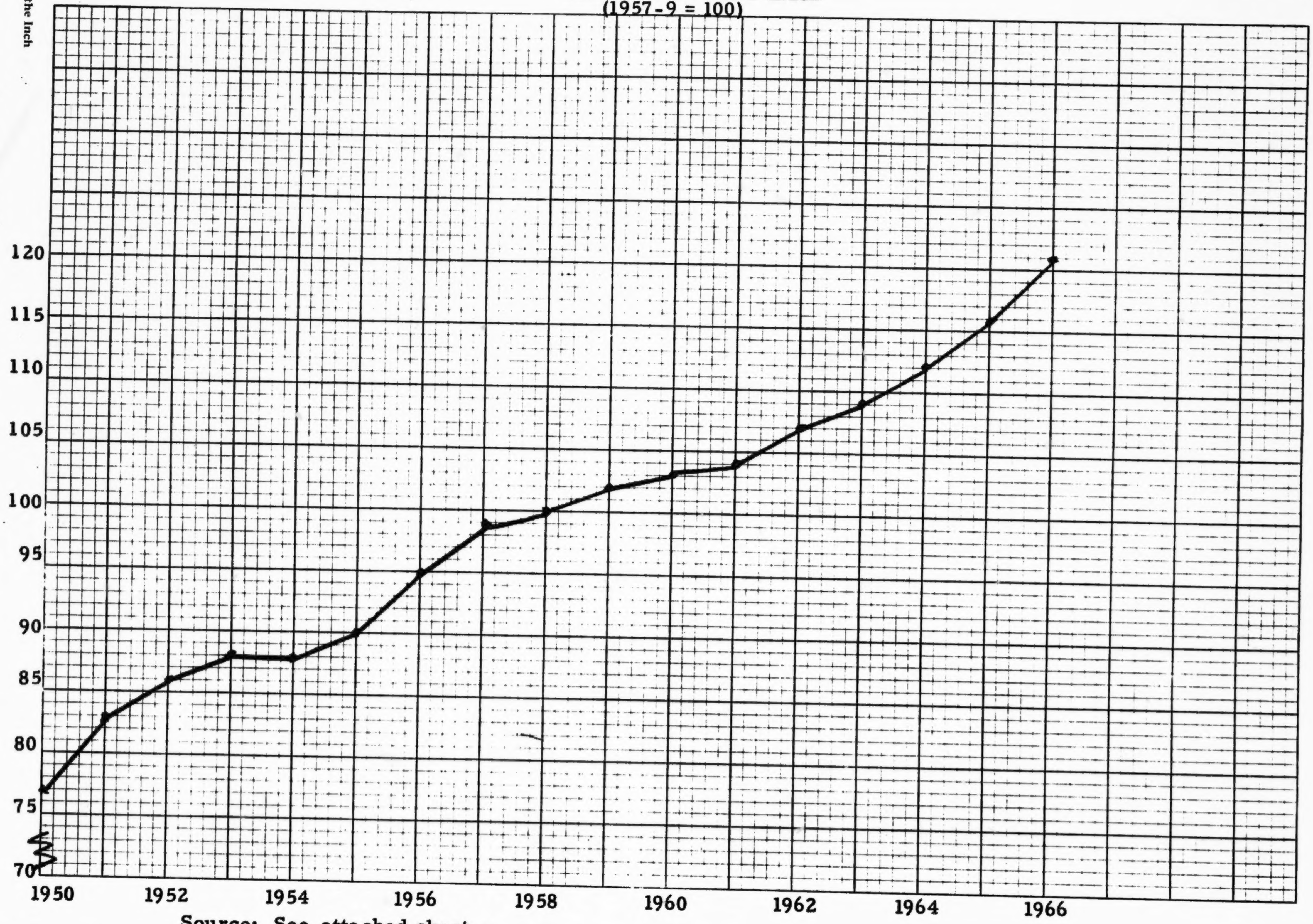
One may conclude from these figures that a substantial backlog of decrepit facilities exists, but its actual magnitude is open to doubt. Expenditures do appear to be rising rapidly, which should be alleviating the problem somewhat. The adequacy of the rate of expenditure cannot be judged on the basis of the statistics or economic considerations alone.

In part, of course, the rising outlays on capital must be attributed also to increasing construction costs. Figure 3 shows for the period 1950-66 the behavior of construction costs. They show that construction cost per square foot has been rising almost without interruption at an annual rate exceeding 2.5 per cent.

3. Rate of Increase in Total Operating Expenditures

The costs of operation of the nation's libraries have risen considerably in recent years. Figures 4 and 5 show paths of operating costs for public libraries and college and university libraries respectively. Obviously they have been rising rapidly. For example, in our sample of 100 college and university libraries the annual operating cost per library

Figure 3
Construction Costs Index
(1957-9 = 100)



Source: See attached sheet.

12-280

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Source: For the years 1950 - 1964

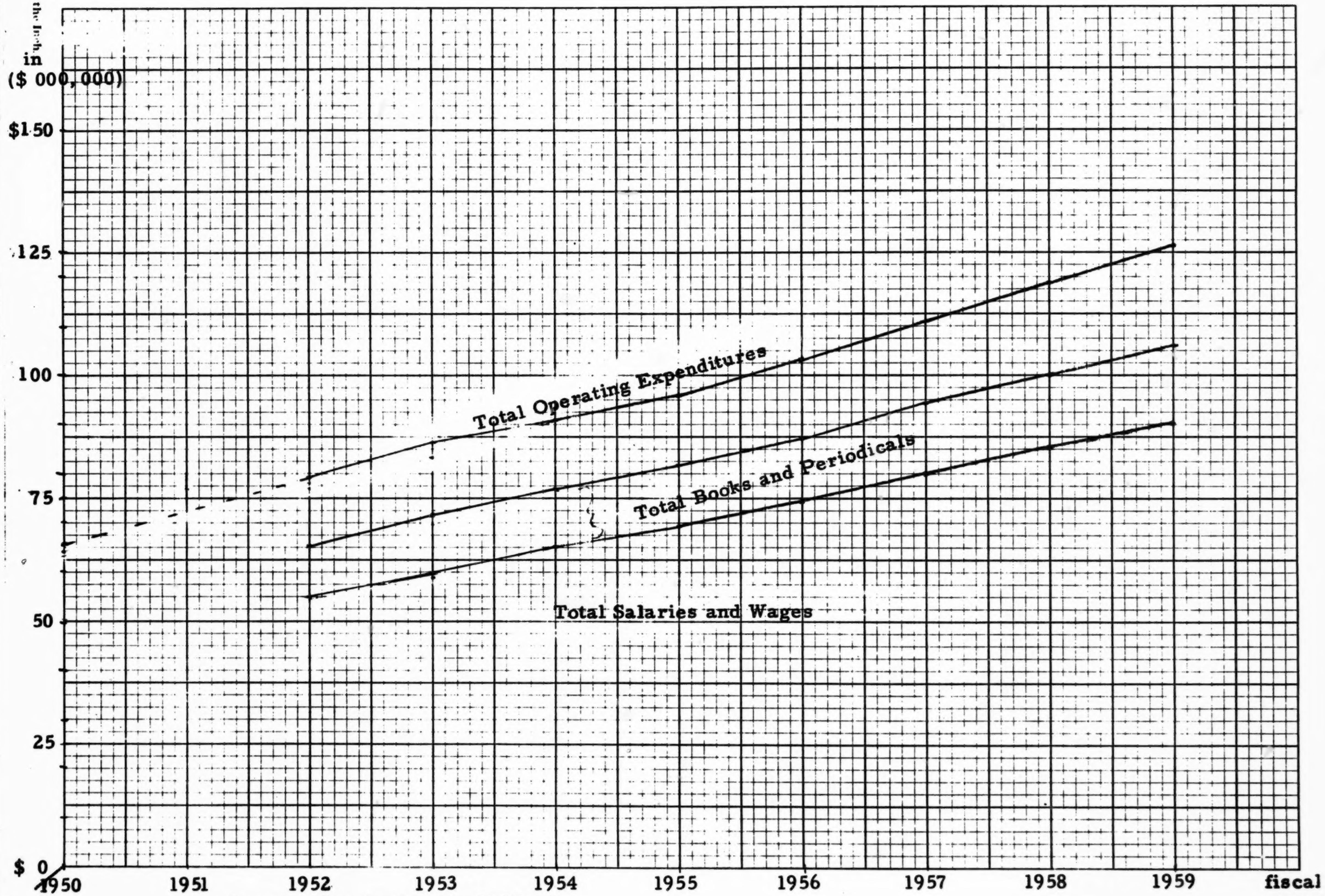
U. S. Department of Commerce, Office of Business Economics, Business Statistics, 1965 Biennial Edition, p. 52.

For the years 1965, 1966
U. S. Department of Commerce, Business and Defense Services Administration, Construction Review, April, 1967, p. 42.

Note: This is a Department of Commerce composite cost index: "an average, computed by the Bureau of the Census, of various cost indexes, largely privately compiled, weighted by the value in place estimates for the individual construction categories to which they are applied."

Figure 4

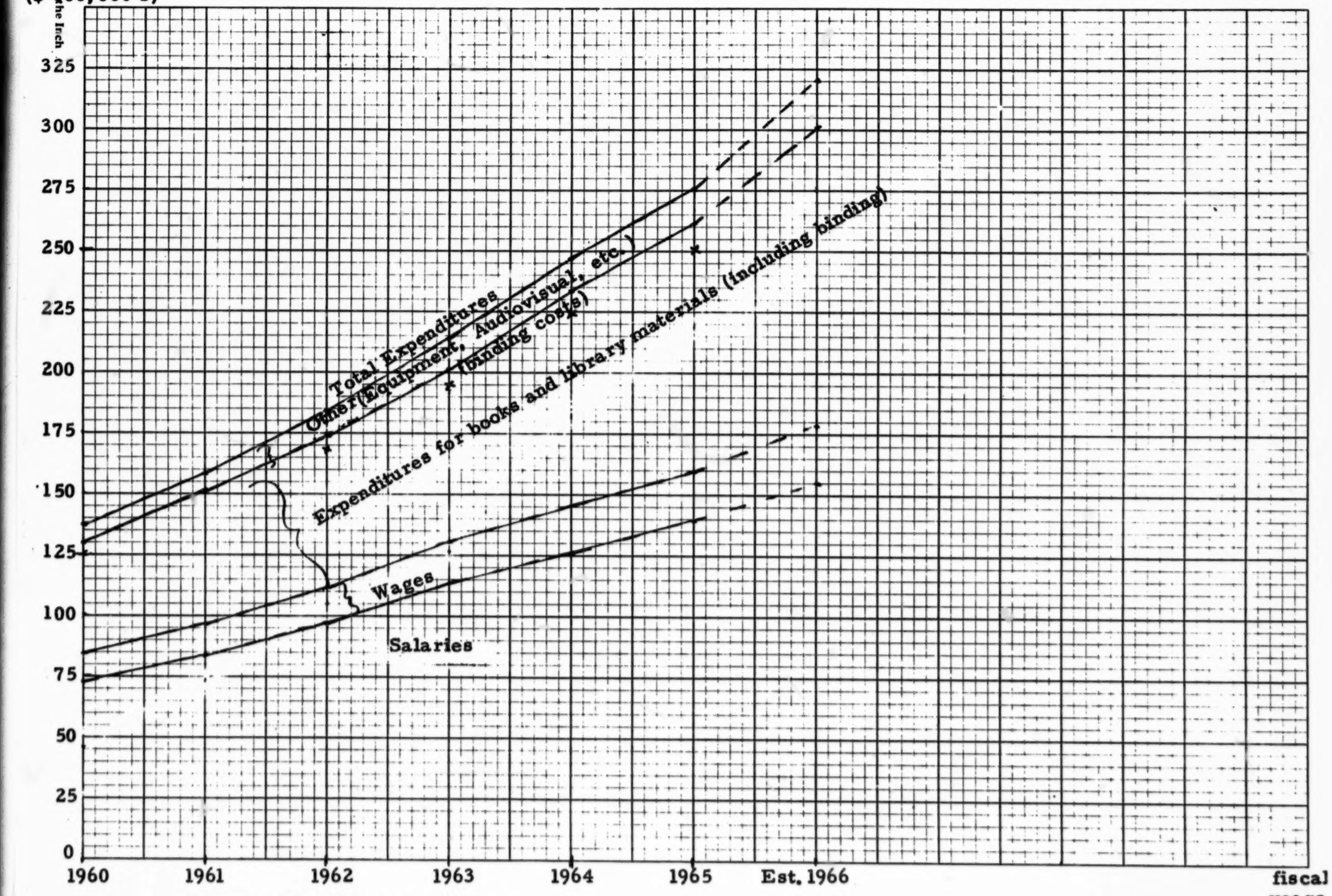
Operating Expenditures for Public Libraries Serving Cities With a Population of 50,000 or More (in $ 000,000's)



Source: See footnote to Table 1.

Figure 5

Total Expenditures for College and University Libraries for Aggregate U. S. A. (in $ 000,000 's)



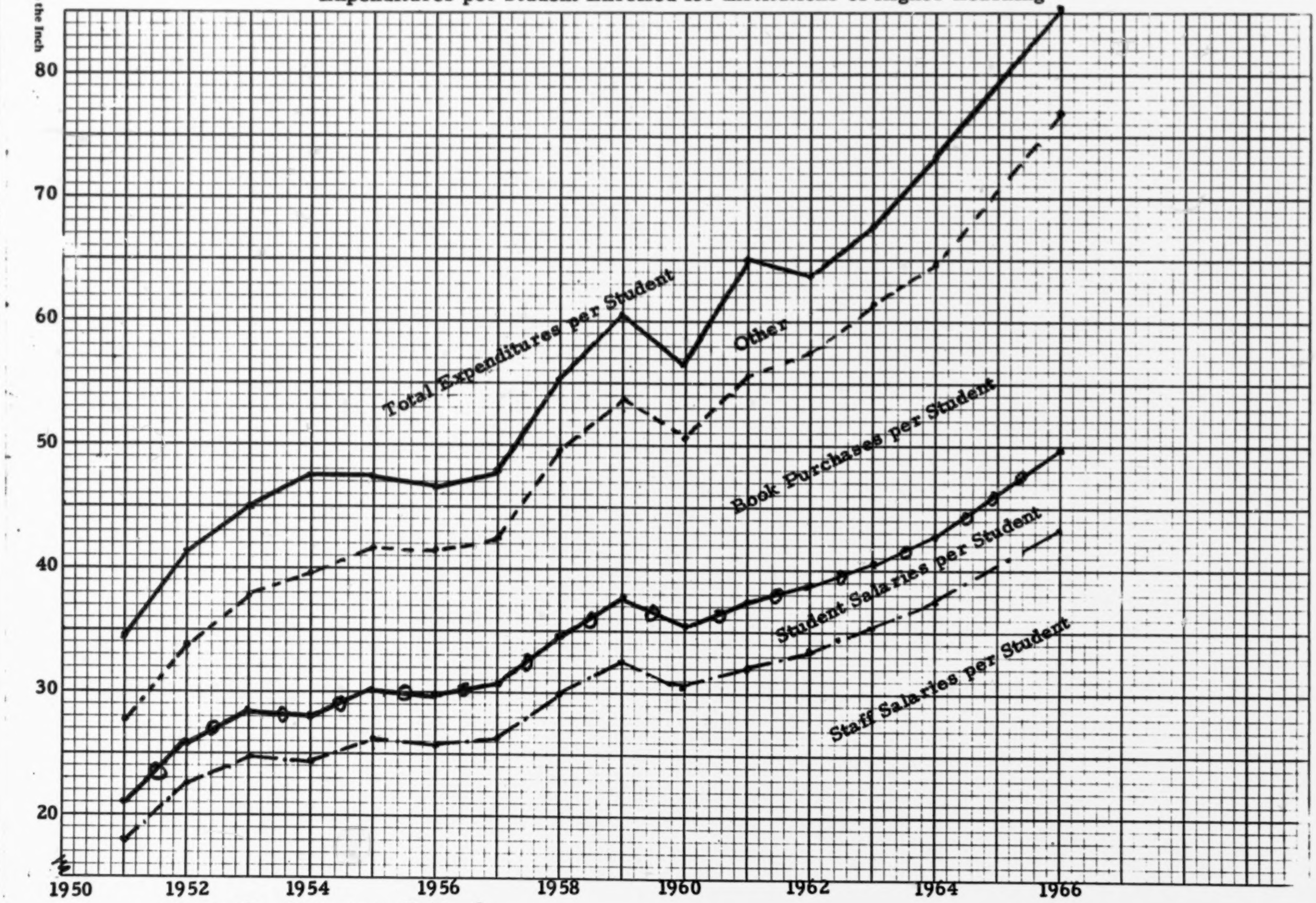
Source: See footnote to Table 4.

has risen from approximately $280 thousand in 1957 to about $880 thousand in 1966. The figures represent more than a trebling in outlays over the decade. As Figure 6 shows this rise in outlays has exceeded substantially even the very well publicized increase in college and university student bodies. Figure 6 describes library operating expenditures per student from 1951-1966 and it grows clear that even this ratio has gone up at an extremely rapid rate. A similar result is indicated by the figure for public libraries in cities with populations of 50,000 or more, which shows that over the decade 1950-1959 operating outlays on the libraries in the sample increased to more than 300 per cent of their initial level from some 64 million in 1950 to 125 million in 1959. In part this represents a steady rise in number of volumes carried and number of volumes added annually (Figure 7) as well as a steady rise in circulation (Figure 8). But we shall see presently, there is more to the matter.

In any event, a moment's consideration shows that these figures, if they represent any sort of portent for the future, are rather frightening. Over a period when the rate of inflation was relatively small the cost of operation of a

Figure 6

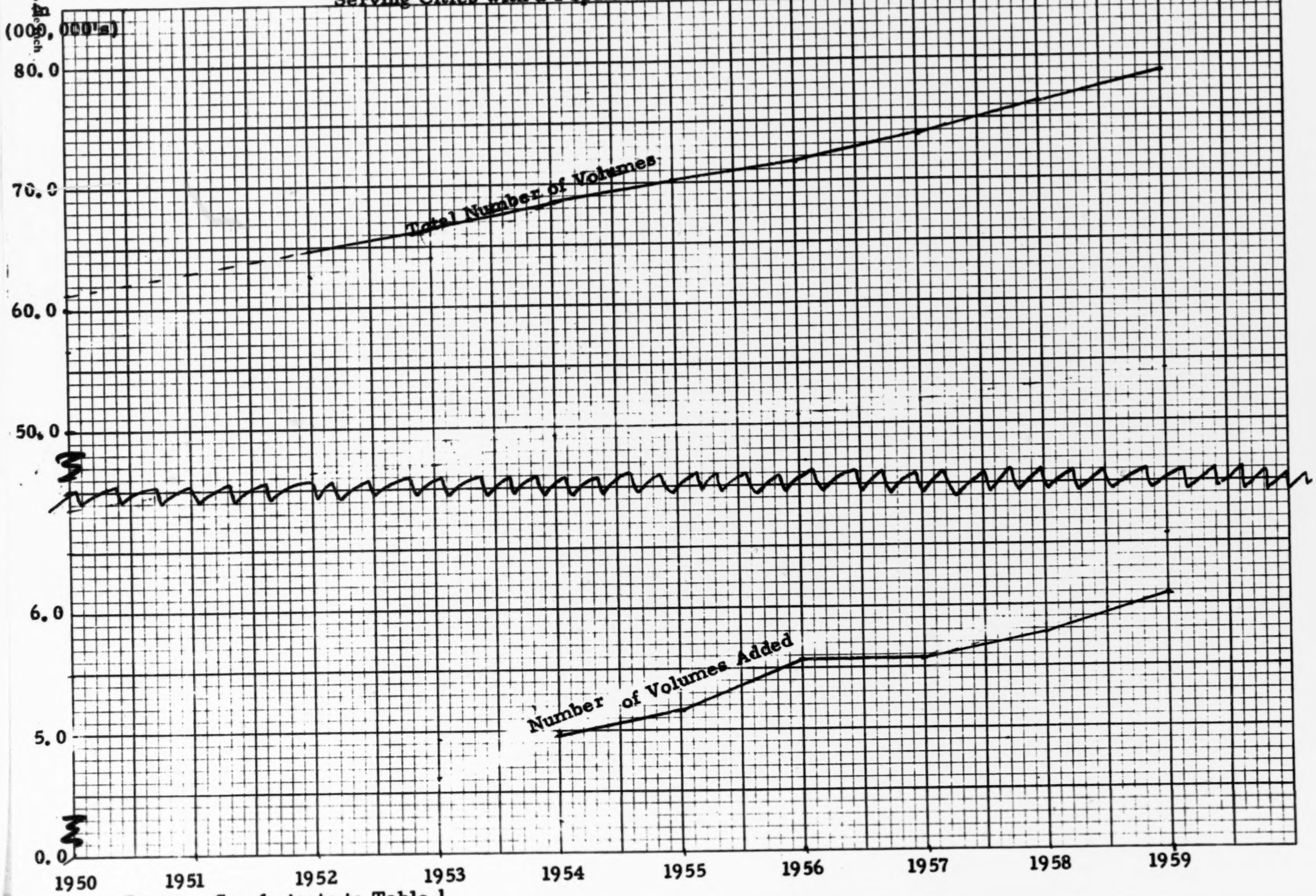
Expenditures per Student Enrolled for Institutions of Higher Learning



Source: See footnote to Table 2.

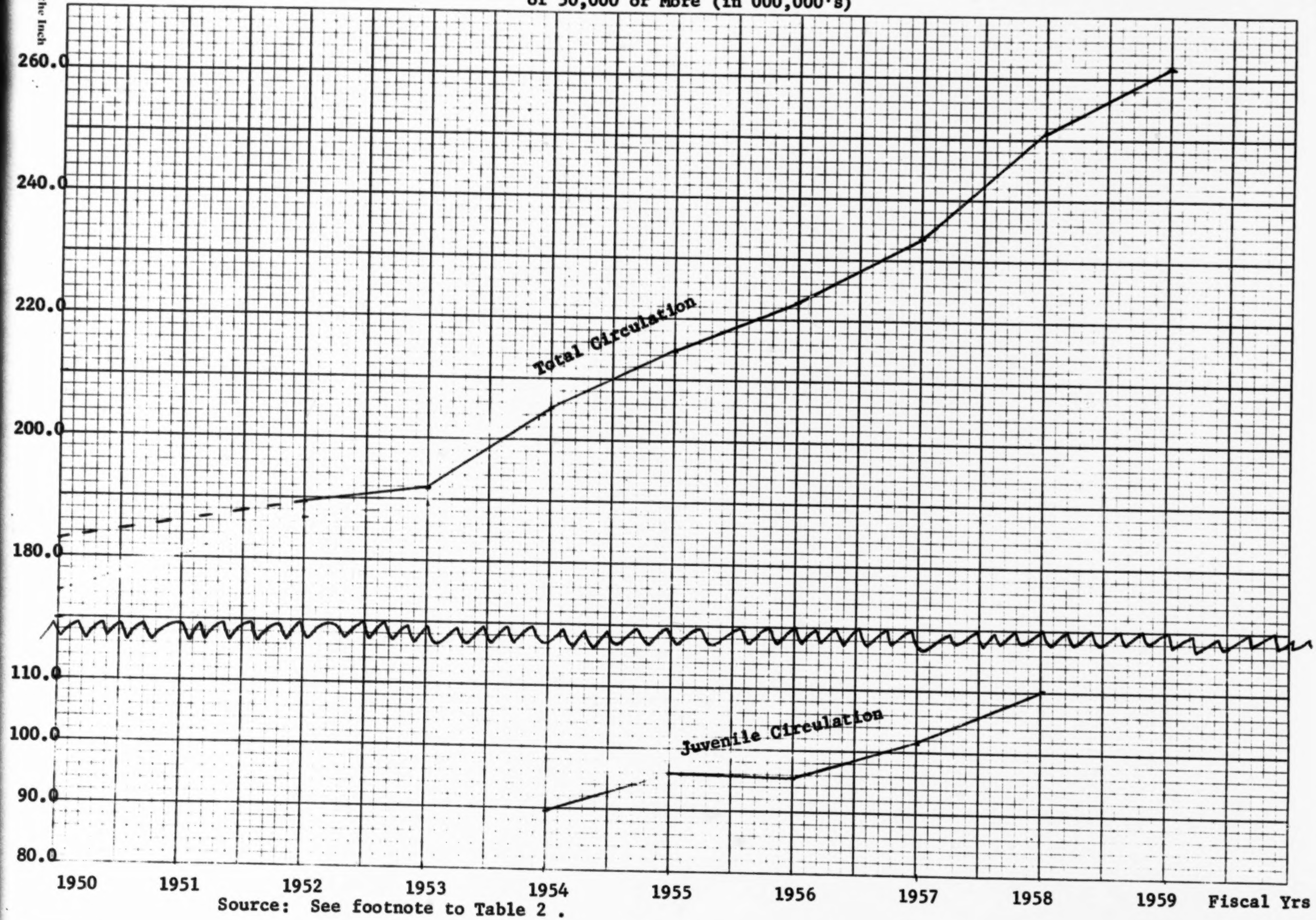
Figure 7

Total Number of Volumes and Number of Volumes Added to Public Libraries Serving Cities with a Population of 50,000 or More (in 000,000's)



Source: See footnote to Table 1.

Total Circulation of Public Libraries Serving Cities with a Population of 50,000 or More (in 000,000's)



Source: See footnote to Table 2 .

library was trebling every decade. It is difficult to overstate the long-run financing problems that are implied by such a figure.

4. Book Prices and Library Salaries

We can go considerably further in the analysis of the components of the increasing cost of operation of a library. The next few sections of this report are devoted to that subject.

Obviously, basic issues in the analysis of the public library cost trends are the rates of increases in book prices and personnel salaries.

The attached charts, Figures 9, 10, 11, 12, and 13 show the figures on salaries and book prices that have been deduced from public library expenditure data.[11] Figure 9, for example, gives the trend rate of increase of book prices for public libraries serving cities of size 100,000 and over as 3.2% per year over the 1953-62 period. Figure 10 gives the rate of increase of salaries as 3.9% per year. The lines

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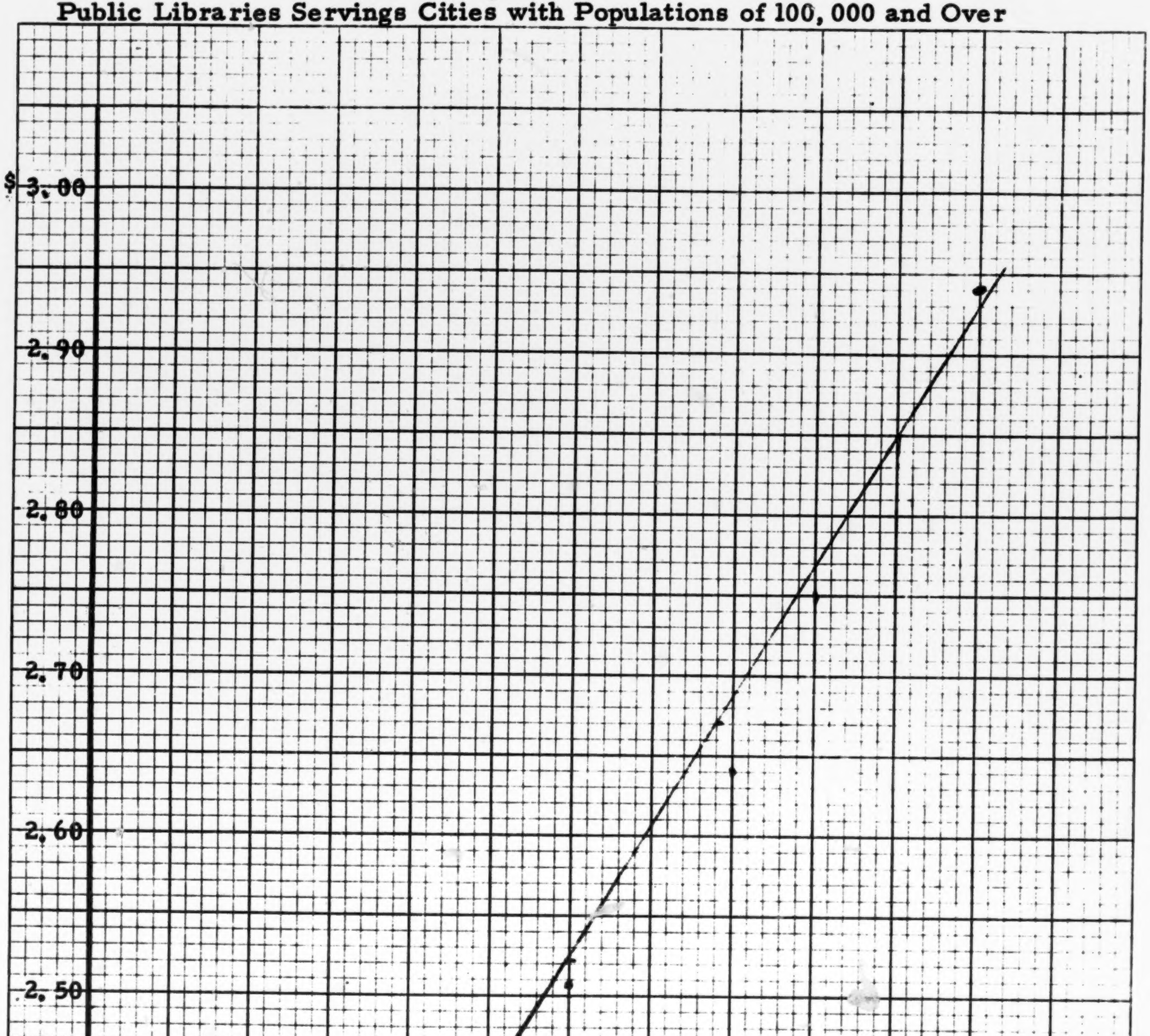
[11] These figures give, in the form of a scatter diagram, the average salary per employee and the average expenditure per book purchased for public libraries reporting in the U. S. Office of Education's annual surveys between 1954 and 1962, grouped by size of population area served. Trend lines were fit by hand, so as to run through the point of means.

Figure 9

Trend in Cost per Book Purchased

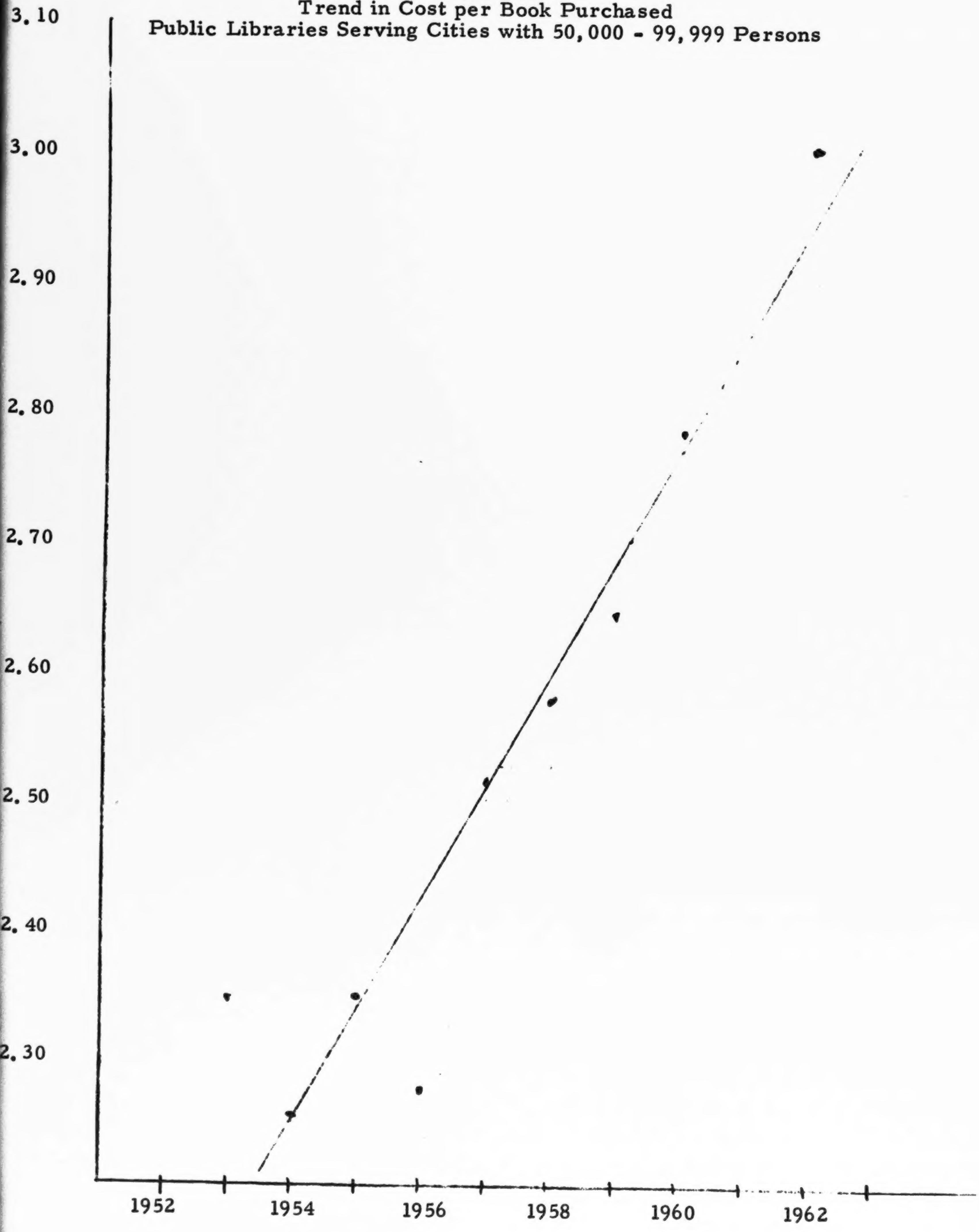
Public Libraries Servings Cities with Populations of 100, 000 and Over



Source: See footnote 11.

12-280
Squares to the Inch

Figure 10
Trend in Cost per Book Purchased
Public Libraries Serving Cities with 50,000 - 99,999 Persons

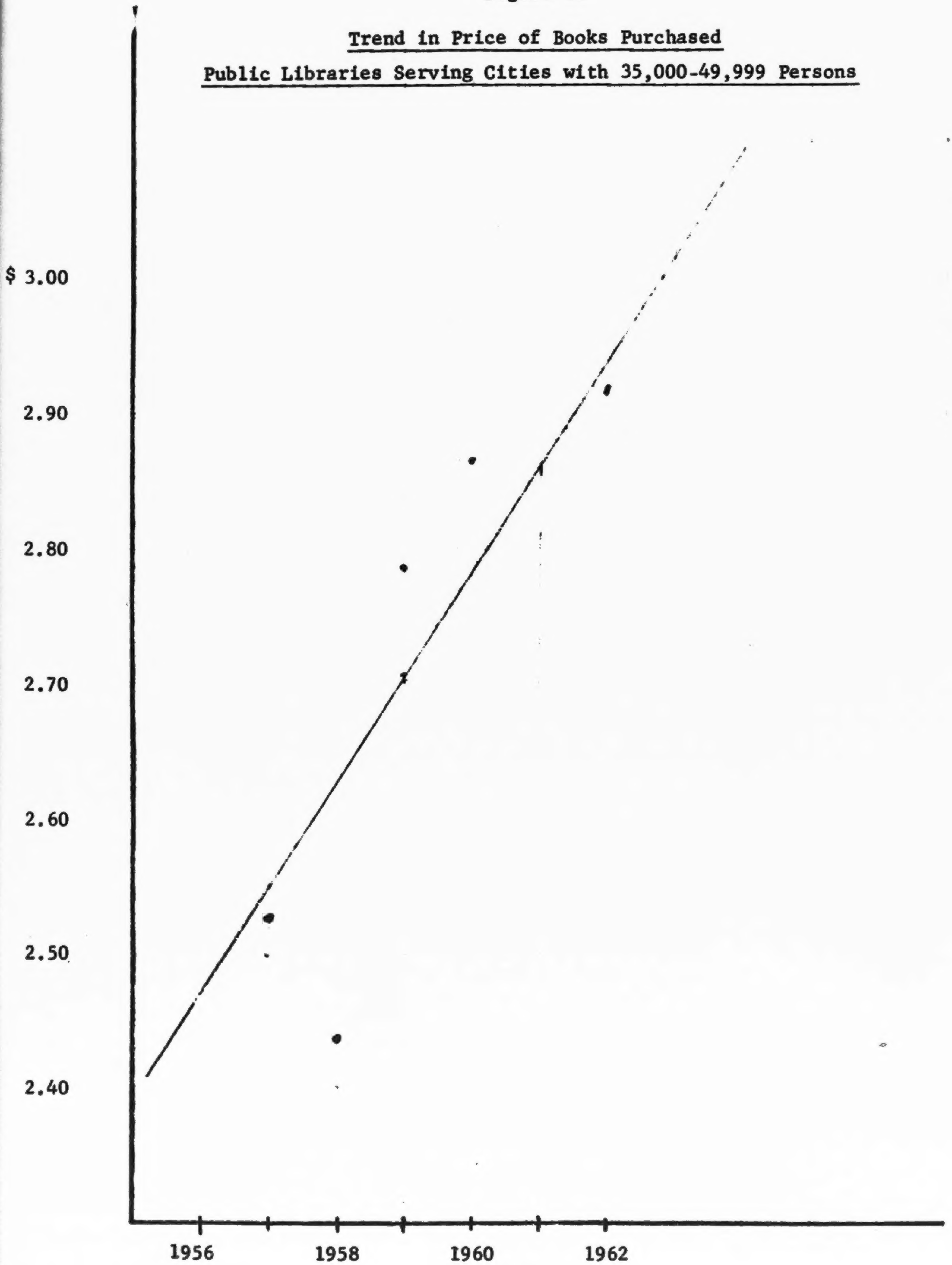


Source: See footnote 11.

Figure 11

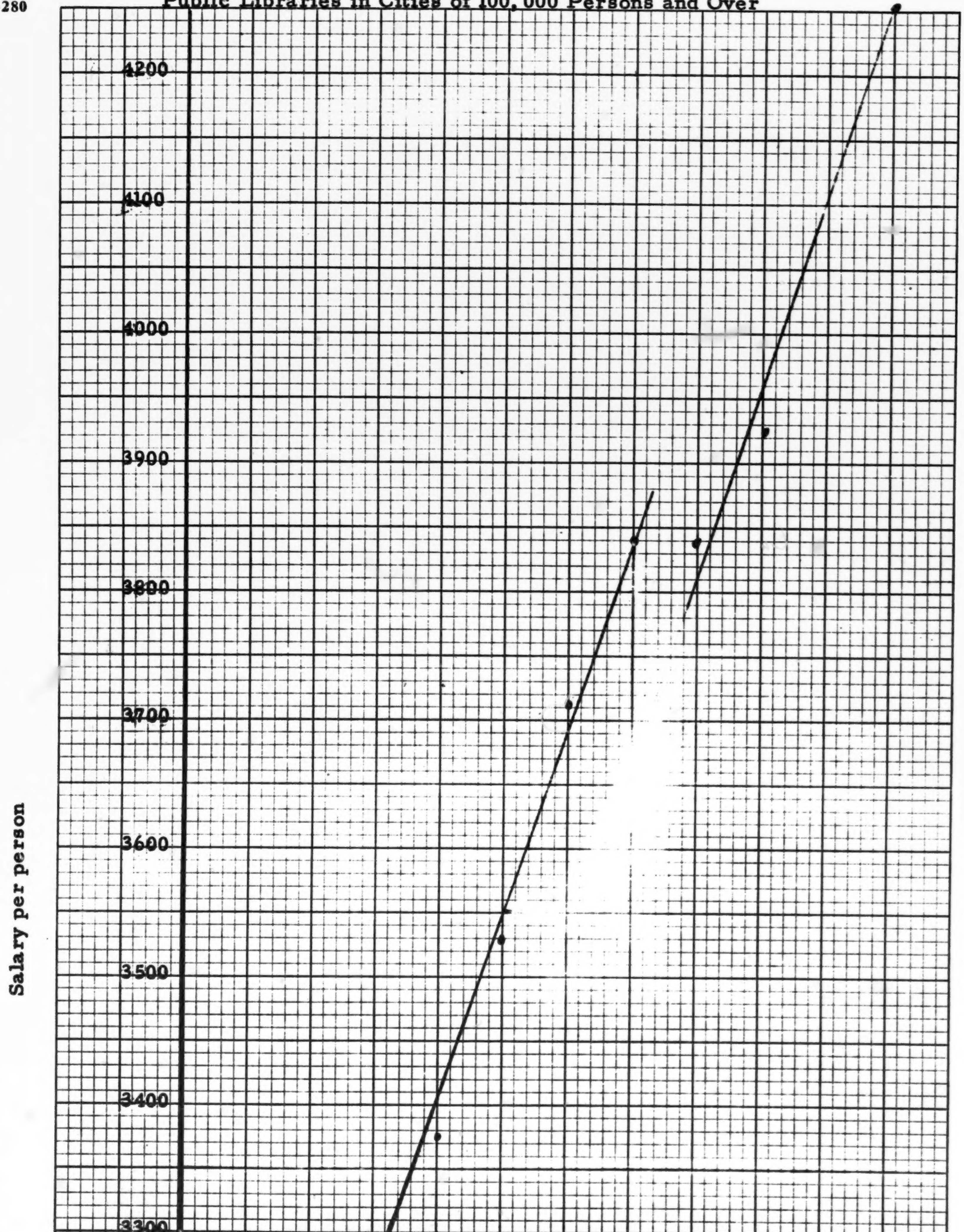
Trend in Price of Books Purchased

Public Libraries Serving Cities with 35,000-49,999 Persons



Source: See footnote 11 .

Figure 12
Trends in Librarian Salaries
Public Libraries in Cities of 100, 000 Persons and Over

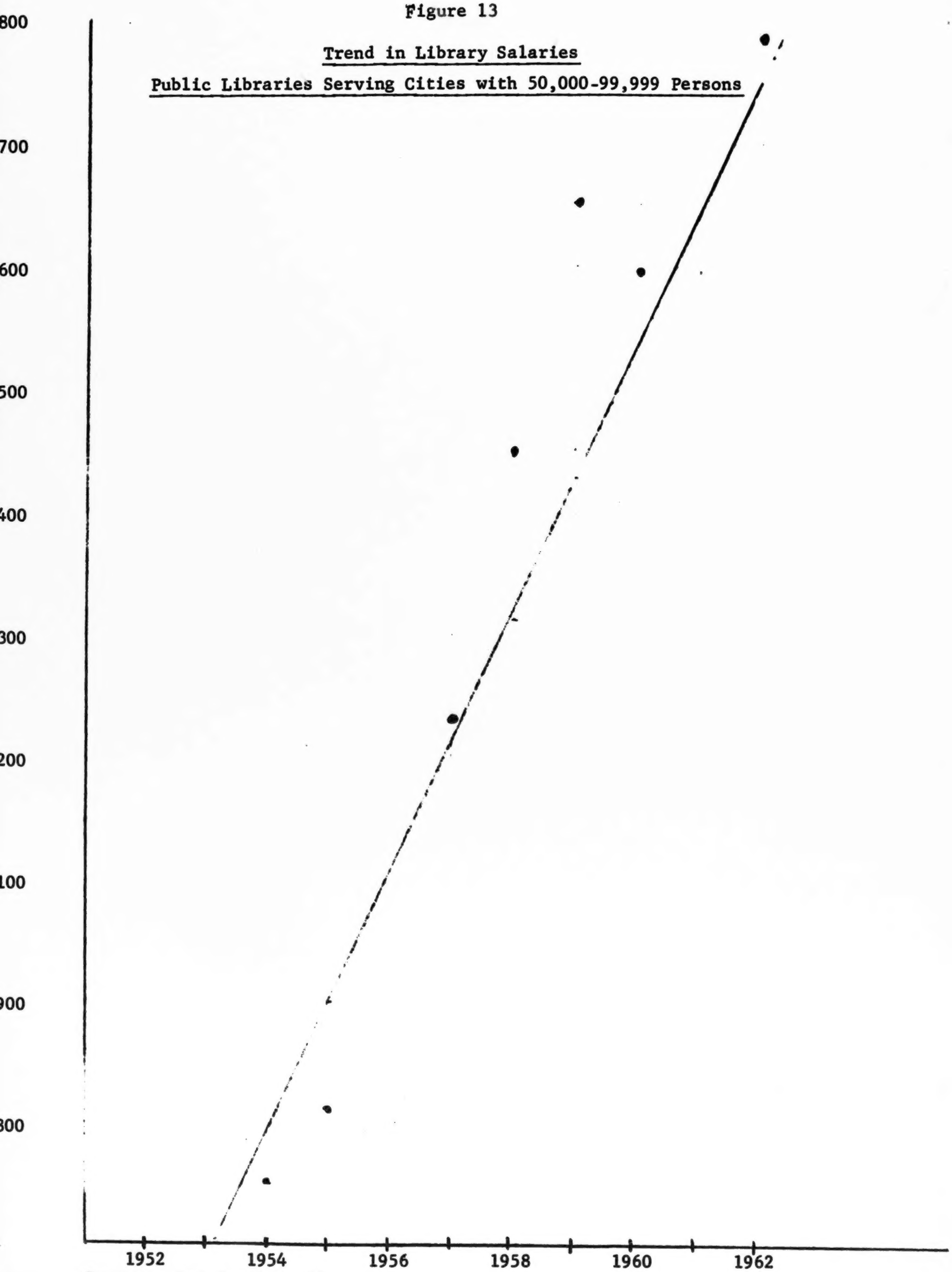


Source: See footnote 11.

Figure 13

Trend in Library Salaries

Public Libraries Serving Cities with 50,000-99,999 Persons



Source: See footnote 11 .

drawn on the charts suggest that absolute rates in book prices and salaries have been fairly steady. Results for each size group are shown in Table 8.

Table 8

Trend Rate of Growth of Cost per Unit of Input[12]

City Size	Books	Staff
100,000 +	3.2% per year	3.9% per year
50-100	3.5%	3.2%
35-50	3.0	NA

In 1966 some 4.4 million volumes were purchased by our sample of college and university libraries at an aggregate cost of $28 million, implying that they must have expended an average of a little more than six dollars per volume. This contrasts with an average acquisition cost of approximately four dollars per volume. (1.8 million books for an outlay of $7 million) one decade earlier, suggesting an average annual rate of increase of 4 to 4 1/2 percent.

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[12] The trend rates are computed as the ratio of the average annual increment given by the trend line to the mean value for the period.

It has been estimated that the collections of major university libraries and scientific publications have both grown at about 6 per cent per year.[13] We have already seen (Figure 7) that for public libraries the number of volumes and the number of volumes added per year has grown steadily. This together with the growing cost per book contributed materially to public library operating costs. Figure 14 shows that similar trends hold for college and university libraries with the total number of volumes over the period 1951-66 just about keeping up with the rapid rise in student population. The lower portion of the graph shows that the acquisition rate has, in fact, been going up far faster than the number of students.

Figure 15 deals with expenditures on personnel per staff member in college and university libraries. It shows that these have been going up rather quickly, rising by more than 50 per cent over the decade 1957-66. However, to see whether this implies that library staff salaries have risen at a fairly substantial rate we must compare these figures

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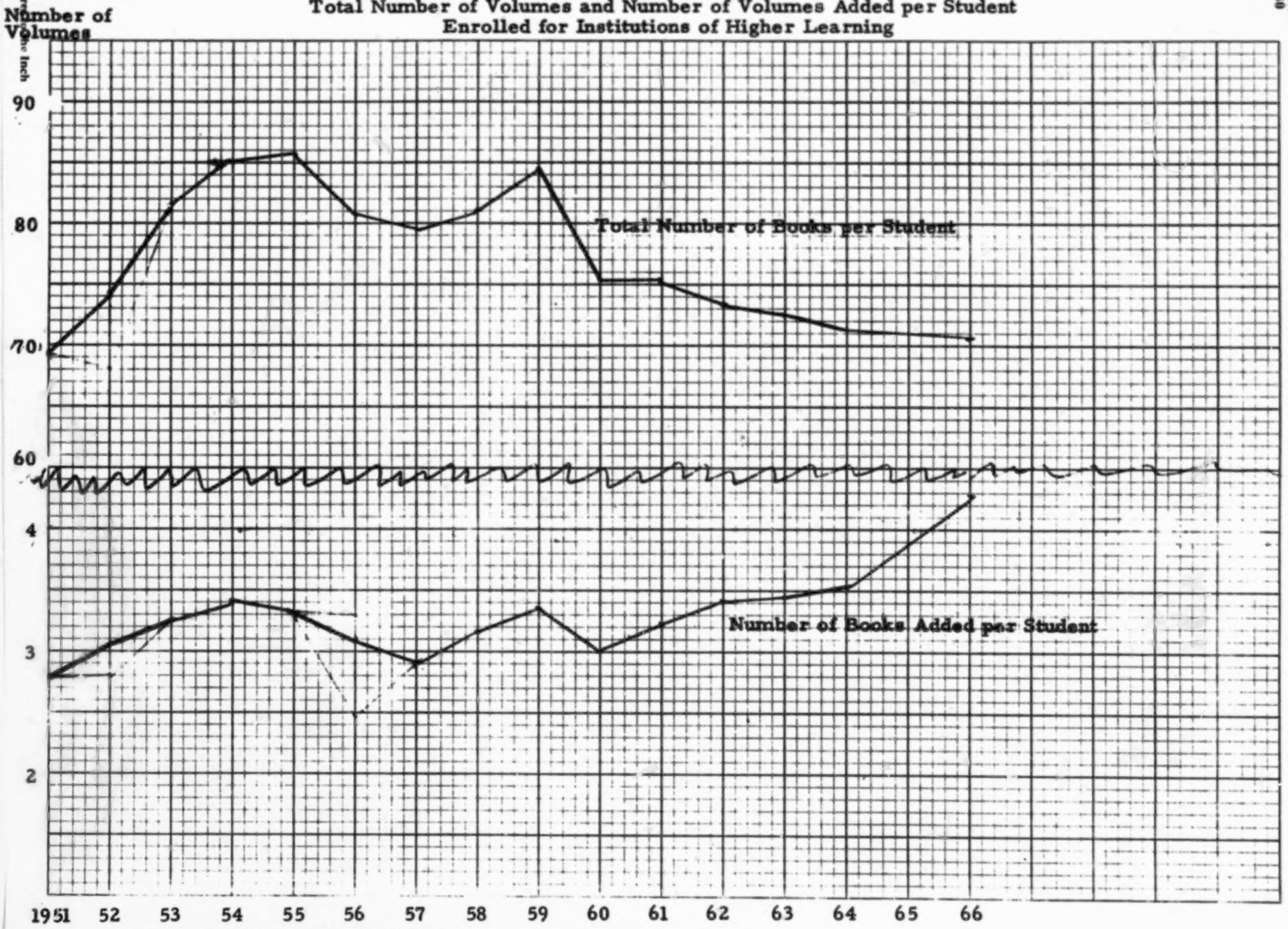
[13] J. P. Danton, Book Selection and Collections: A Comparison of German and American Universities, Columbia University Press, New York, 1963 and Johnson, E. A. "The Crisis in Science and Technology and Its Effect on Military Development," Operations Research, Vol. I, 1958 pp. 11-34.

Figure 14

Total Number of Volumes and Number of Volumes Added per Student Enrolled for Institutions of Higher Learning



Source: See footnote to Table 3.

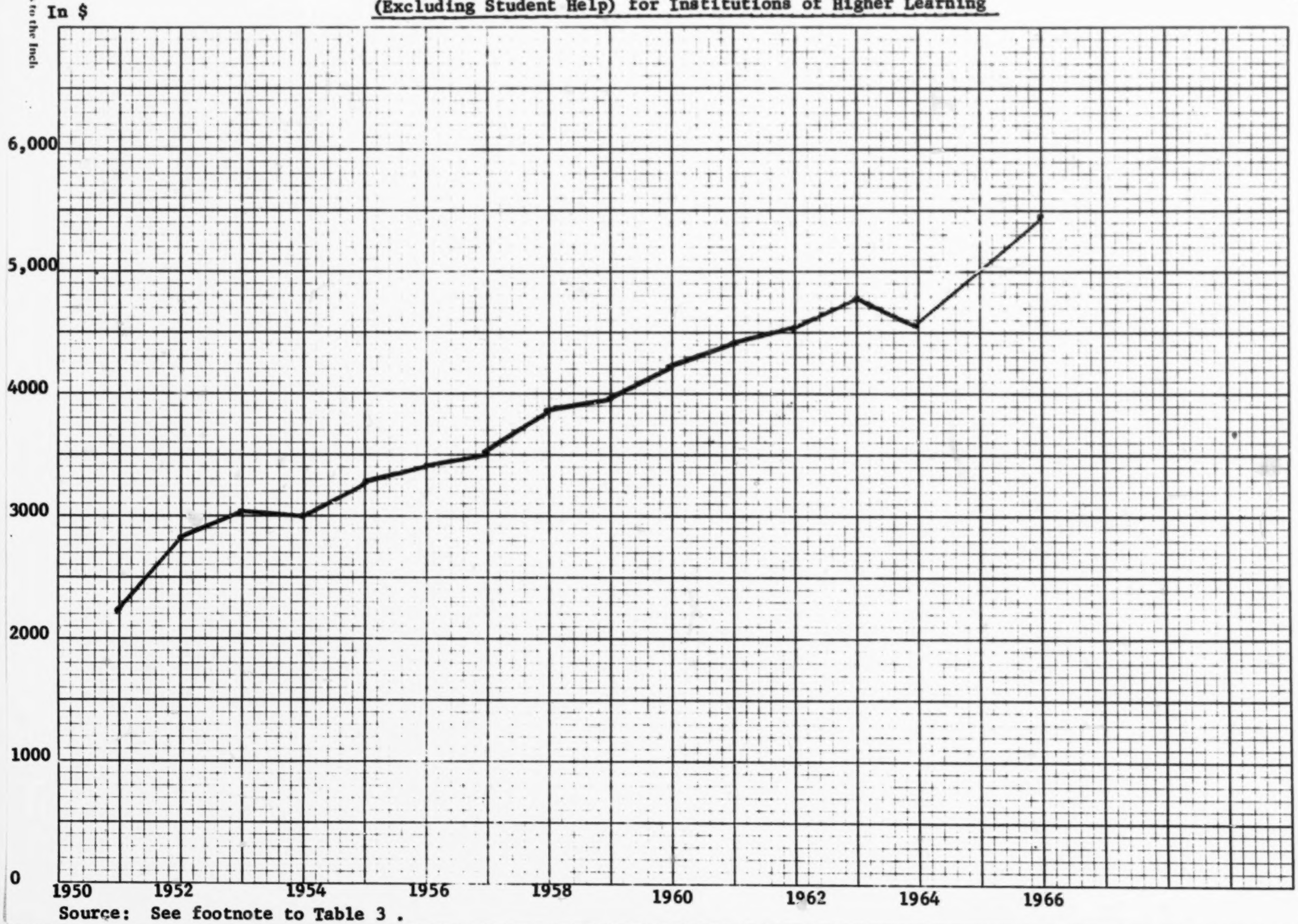
10 Squares to the Inch

12-280

Figure 15

Average Salary Per Full-time Library Equivalent

(Excluding Student Help) for Institutions of Higher Learning



Source: See footnote to Table 3 .

with data on the behavior of other types of income.

Figure 16 shows the behavior over the period 1951-1966 of the salaries of library personnel in college and university libraries in relation to the cost of living, to per capita personal income in the economy as a whole and to the compensation of college and university professors.

The figure shows that over the period reported library salaries have increased at a surprisingly substantial rate of 4.8% per year. No doubt this represents in large part compensation for a lag in real incomes during the war and early postwar periods. But we note that over the period shown librarian incomes have gone up much more rapidly than the cost of living, thus representing a significant rise in purchasing power. Moreover, librarian incomes have risen far more rapidly than per-capita personnal incomes in the economy, so that the relative economic position of the librarian has also improved.[14]

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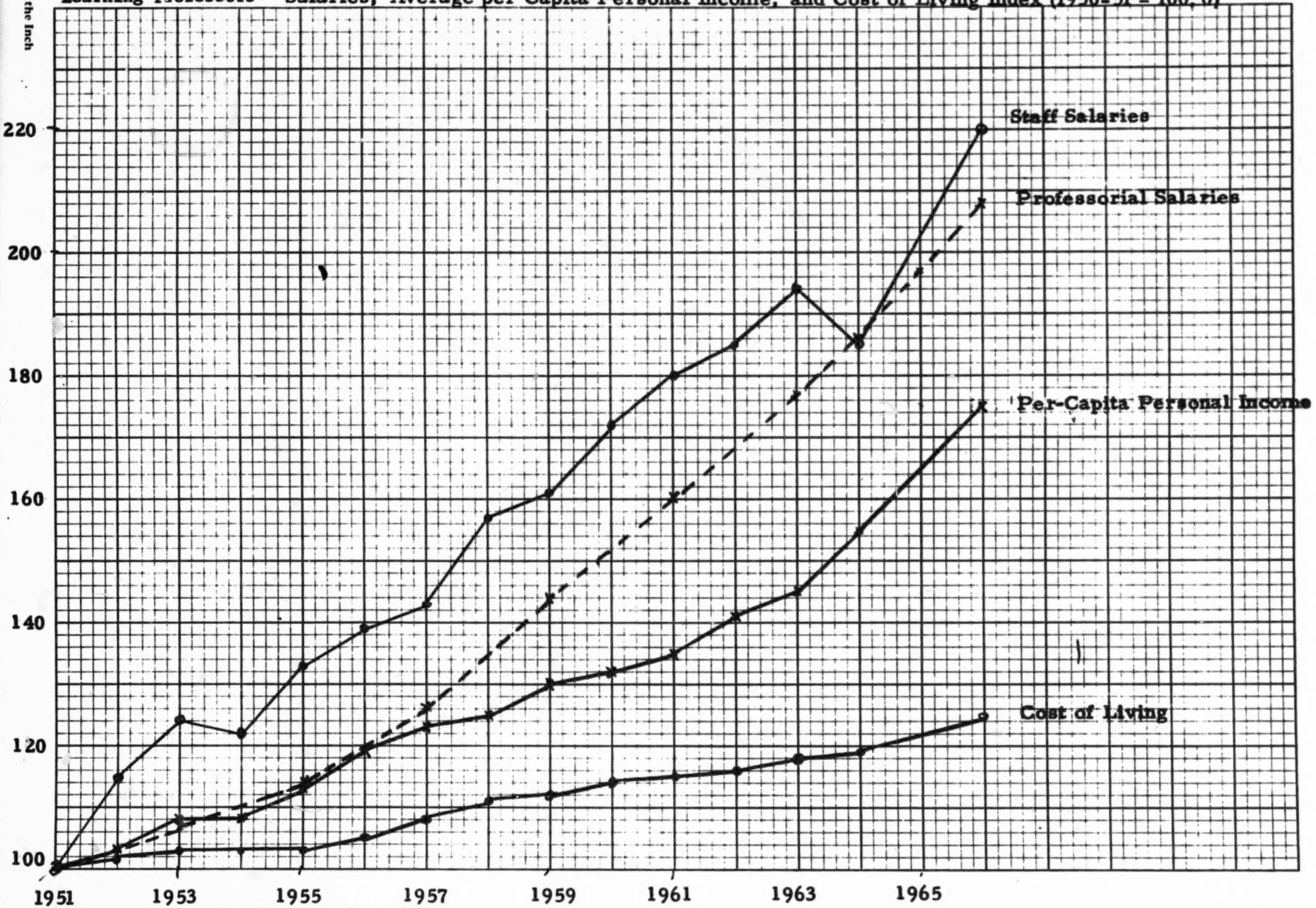
[14] There is a slight distortion in the comparison resulting from the growth in population during the period which tended to reduce the per-capita income figure. However, this does not affect our conclusion that librarian incomes have risen more quickly than incomes in the economy generally.

Figure 16

Average Library Salary per Full-Time Equivalent Employee (Excluding Student Help) for Institutions of Higher Learning Professors' Salaries, Average per Capita Personal Income, and Cost of Living Index (1950-51 = 100, 0)



Sources: See attached sheet.

10 Squares to the Inch
12-280

Sources:

(a) Staff Salaries: see footnote to Table 3.

(b) Professorial Salaries for Full Professors in 36 Universities: American Association of University Professors, as communicated by Mlle. Maryce Eymanniére.

(c) Per-capita Personal Income; Cost of Living: Economic Report of the President transmitted to the Congress January, 1967, together with The Annual Report of the Council of Economic Advisers, U. S. Government Printing Office, 1967, pp. 232, 262.

We note that over the entire period librarian incomes have exhibited trends very similar to those of professional salaries. Indeed, during the earlier portion of the period shown, the beginning of the 1950's, the librarian's remuneration went up far more rapidly than that of the college professor. Since then, however, the two seem to have been rising at roughly the same rate.[15]

Part III. An Analysis of Library Cost Trends

1. Cost Trends and the Nature of Library Technology

Before turning to an examination of more of the pertinent facts, it is desirable to provide an analysis which will bring them into focus. Parts of the discussion which follows are, unavoidably, somewhat abstract. The reader will soon see, however, that the implications are quite tangible and pertinent for the operation of the libraries.

In analyzing library costs, the economist approaches the problem with no sentimental preconceptions. He considers a library to be, in effect, a workshop in which, with the aid of a number of productive processes, certain services are provided. It is only in the evaluation of these services and their social benefits (a subject to be discussed below) that he treats a library differently than he does any other productive process such as the manufacture of shoes or the supply of engineering design services. By examining the technology of the library from such a matter of fact viewpoint, the economist is better able to arrive at the nature of its cost problems and the requirements for its efficient operation.

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[15] In the figure there is a peculiar dip in the earnings of library staff members reported for 1964. This probably represents some change in composition of the sample and an addition in the number of junior staff members, which pulled down the overall average salary figures.

In many respects, as will be seen, the technology of a library has much in common with that of a college. The separate nature of the cost structure of the nation's colleges is epitomized in three factual observations, each of them straightforward but which, together, constitutea paradox. These facts are the following: First, taking into consideration longer periods of time, the compensations of college teachers have risen less rapidly than incomes in the population as a whole.[16] Second, in the budgets of liberal arts colleges, salaries constitute the largest single component in operating costs, excluding the cost of construction and the supply of other capital. Third, the costs per unit of service supplied, i. e., the cost of providing a student with one year of education, has risen far more rapidly than the average cost of all items supplied in the economy. None of these three facts, each of which is readily documented, is remarkable in itself. The lag in faculty salaries has been widely publicized, the relatively low non-salary costs of the colleges follows from the fact that they use small quantities of fuel and raw materials (paper, pencils ?) in comparison with most manufacturing processes, and many parents have felt the effects of rising costs in the mounting tuition payments and the growing requests for contributions to which they have been subjected.

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[16] " The Economic Status of the Academic Profession: Takin Stock," 1964-65, AAUP Bulletin, Vol. 51, No. 3, Summer, 1965, pp. 249-250.

Yet, the three observations together constitute a remarkable phenomenon--in effect, they state that college costs are largely composed of salaries, salaries in college have risen more slowly than elsewhere , and yet, cost per unit of college service has risen more rapidly than those in the remainder of the economy! The explanation of this paradox is no mere curiosum. As will be seen presently, it accounts for the essence of the financial pressures which beset the nation's colleges, and similarly, it serves as the basis for the analysis of a substantial part of the economic problems of our libraries.

Before turning to this explanation and its relevance to the circumstances of the libraries, one aspect of the preceding assertions bears some additional emphasis. The rising costs of colleges can be ascribed to a variety of sources--to the growth in population, to rising incomes, which leads a larger proportion of our population to demand a higher education and to inflation, which causes increases in costs almost everywhere in the economy. However, the increases in costs which have been described go beyond what can be accounted for by any of these phenomena; we have been speaking of rising costs per student per semester, which means that the financial needs of our colleges would have increased even if there had been absolutely no growth in the size of the student body. These increases in cost go beyond anything that can be accounted for by inflation, for their magnitude is greater than the rate of cost increase elsewhere in the economy, i.e., they exceed in magnitude the rate of price rise which characterizes the inflationary process.

As we shall see, this all means by direct analogy that, even if we were to be satisfied to offer no improvements in the services offered by the libraries, no increase in number of persons served and no growth in the number of volumes carried, the costs of library operation could be expected to rise. Moreover, it will be shown these rises alone are, by their nature, progressive and cumulative. This suggests that those who supply the funds which support our libraries have not recognized the full extent of their obligation. They must learn that even with no improvement in library service, the amount which suffices to support our libraries today will prove inadequate tomorrow, and the amount which is enough for their maintenance tomorrow will be insufficient the day after that. This is no fortuitous manifestation of the current state of the economy but is rather a result inherent in the technology of library operation.

2. The Role of Human Effort in Library Technology

The similarity of the cost trends which characterize the libraries and the colleges is not a matter of accident.

Both their production processes differ in at least one important way from those of a substantial segment of the economy. This difference consists of the central role of the direct services of trained personnel. In either activity, any substantial reduction in the amount of labor time supplied by these persons per unit of output is likely to cause a deterioration of the product. At the colleges, some reduction in the amount of faculty time per student may, in some circumstances, actually increase the quality of education. But surely, after some point any further reduction in this amount, which generally means a further increase in the size of classes, must have serious educational consequences. There simply is a limit to the level of class size one is willing to tolerate--certainly, classes with 100 students and lectures with 2000 attendees are not considered highly desirable.

Effective utilization of a library also requires at least minimal expenditures of labor time. In elementary school libraries, pupils must be taught how to use the facilities, and even scholars who have had long practice in the use of library services frequently need help in locating the rare volume or the item alluded to in an incomplete reference. All of these require substantial amounts of the time of skilled librarians, for whom there is no really satisfactory substitute.

Both of these activities represent a marked contrast with the case of manufactured goods. In the production of washing machines, refrigerators, automobiles or electricity the consumer neither knows nor cares about the quantity of labor that goes into the final product. As far as the consumer is concerned, anyone who discovers a way to reduce the amount of labor embodied in a kilowatt-hour of electricity is welcome to do so.

The historic result has been precisely what one might expect. In manufacturing, the product per man-hour of labor has gone up rapidly and steadily. At least since the beginning of the century, productivity has risen at an average compound rate of 2 1/2 per cent per year.[17] This means that the amount of labor per unit of manufactured goods has been reduced by about 50 per cent approximately every 28 years.

We do not know precisely what has happened to productivity per man-hour in the libraries; indeed, we will never know it precisely, because "the number units of product" of a library has no unique definition-- is it the number of books carried? the number of books borrowed? the number of readers served?and what constitutes a unit of reader service? However, there is every reason to believe that, as with most other services , the rate of growth of productivity per man-hour of the librarian has risen much more slowly than it has in manufacturing. Just as one cannot reduce without limit, year after year, the amount of faculty-time in the educational process, the reduction of librarian time (the growth in librarian productivity) is also circumscribed by the nature of the activity.

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[17] Victor R. Fuchs, Productivity Trends in the Goods and Service Sectors, 1929-1961, Occasional Paper 89, National Bureau of Economic Research, New York, 1964.

3. Relative Productivity and Cost Trends

We are now close to the climax of our analysis, the resolution of the paradox with which we began. As manufacturing productivity has risen relative to that in the libraries and the colleges, wages in industry have been rising. Manufacturing incomes have gone higher and higher, partly in response to the growth in productivity. Suppose that wages in manufacturing were to rise at an annual rate of 2 1/2 per cent while librarian incomes trailed behind, increasing only at an annual rate of 2 per cent. What would this mean for costs in the two activities?

In manufacturing, when wages rise 2 1/2 per cent and productivity goes up 2 1/2 per cent the net effect on costs is zero. The rise in wage rate and the reduction in the labor content of the product offset one another precisely. Costs of manufacturing neither rise nor fall. On the other hand, in libraries, since there is virtually no offsetting growth in productivity , the 2 per cent increase in salaries means that labor costs will increase at almost the same rate as salaries-- 2 per cent a year compounded. This result does not depend on the particular illustrative wage figures chosen. It is easy to check that if the rate of increase in earnings were instead 5 per cent in manufacturing and 4 per cent in libraries, then labor costs would rise somewhat more than 2 per cent per year in manufacturing and at 4 per cent a year in libraries. In this case again, we see library compensation figures going up more slowly than those in industry and yet, year after year, inexorably library costs compound far more quickly than those in manufacturing.

The essence of the analysis then is that the technology of the library makes it very difficult to dispense with any considerable proportion of the librarians' services. Thus, it leaves little room for increases in productivity anywhere equal to those which have offset wage increases in manufacturing. As a result, if library incomes go any part of the way toward keeping up with the rise of incomes in the remainder of the economy, the costs of library operation will rise year after year in relation to the costs that characterize the economy as a whole.

One thing to be noted about this analysis is its implication about the effects of a speeding up of the rate of increase of productivity in manufacturing. This indicates that the faster productivity grows elsewhere, the greater will be the resulting cost pressures that beset the libraries. In effect, these library cost increases are part of the price of progress in the manufacturing process; thus, the greater is the rate of that progress, the larger the magnitude of the price that it will exact. This observation is particularly significant because preliminary evidence suggests strongly that the rate of productivity growth in manufacturing has itself been increasing. From its historic level of 2 1/2 per cent it has gone up in the past few years to 3 per cent or even higher. This suggests that the libraries have no reason to comfort themselves with the expectation of any reduction in cost pressures stemming from this quarter.

Before going on to consider the implications of this analysis for the future of the library, or to discuss the policy measures which it suggests, it is desirable to examine the empirical evidence--the facts relating to the longer run trends in library costs and their components.

4. Library Costs Per Unit versus Costs in the Economy

We turn, therefore, to the set of cost data which for the purpose of our central analysis are most crucial. We have recognized that rising circulation, a growing student body and an increasing acquisition rate all play some role in increasing library costs. But we have suggested that these are but supplements to the basic cause of the increase -- that even without them library costs would have risen, and risen far more rapidly than the price level.

This is confirmed dramatically by Figures 17, 18, 19, 20, and 21 which show operating costs per unit of output and their breakdown into personnel and book purchase costs, compared with the wholesale price index in

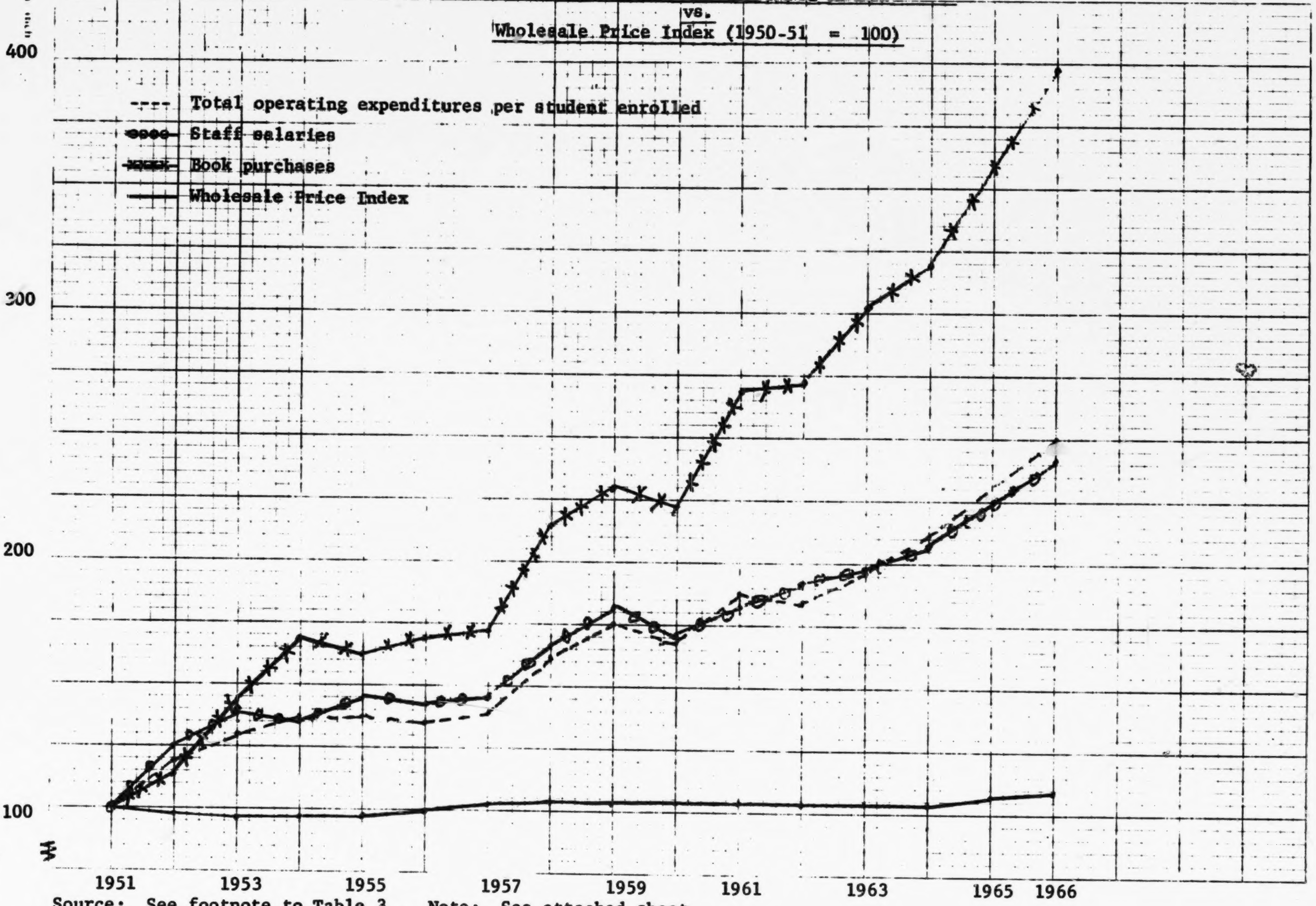
Figure 17

Operating Expenditures Per Student Enrolled

For Libraries of Institutions of Higher Education

vs.

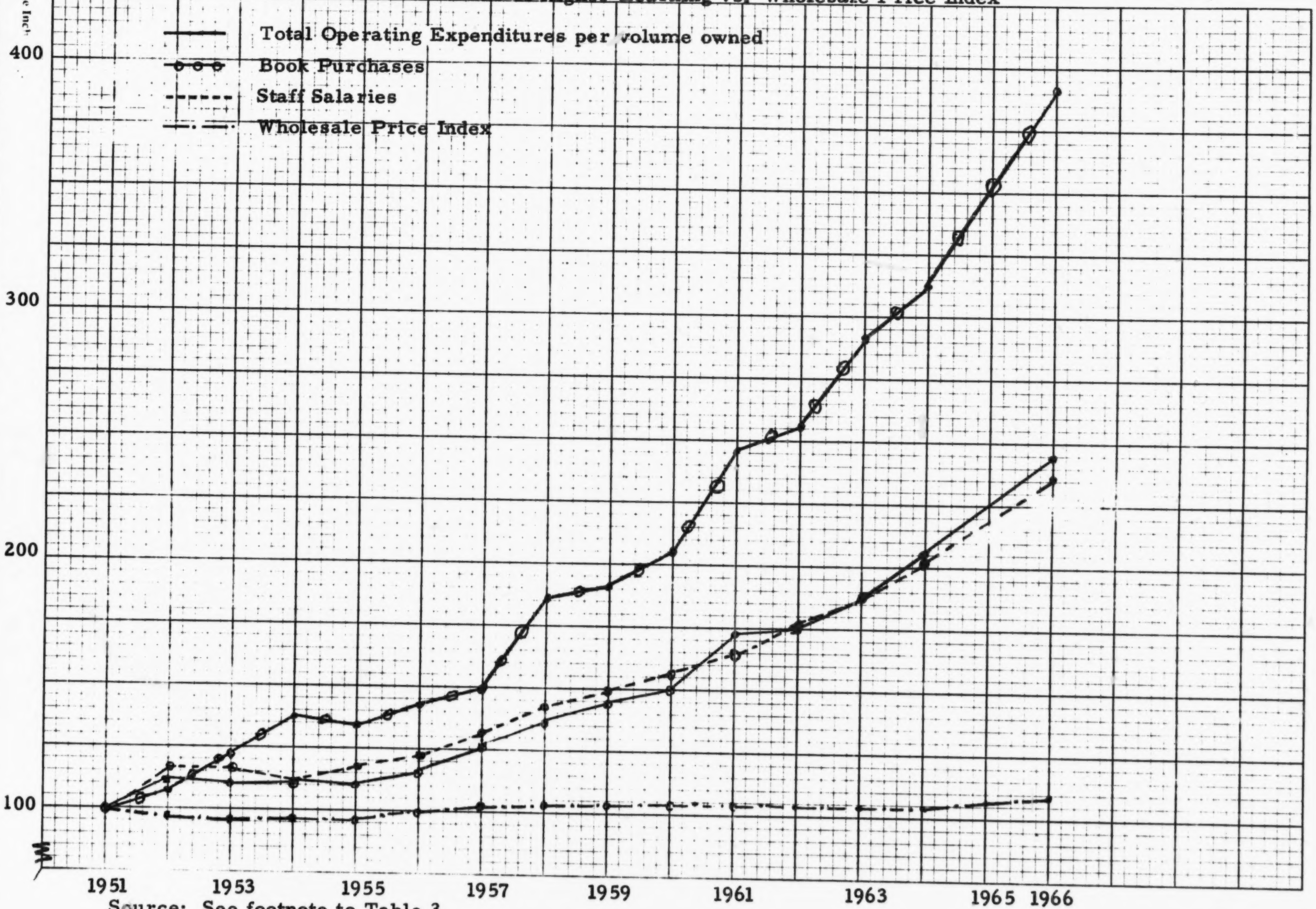
Wholesale Price Index (1950-51 = 100)



Source: See footnote to Table 3 . Note: See attached sheet

NOTE: The Wholesale Price Index for Figures 17, 18, 19, 20, 21, 22 was taken from The Economic Report of the President, transmitted to the Congress, January, 1967, together with The Annual Report of the Council of Economic Advisers. U.S. Government Printing Office, Washington, 1967. p. 264

Figure 18
Operating Expenditures per Volume Owned
for Institutions of Higher Learning vs. Wholesale Price Index



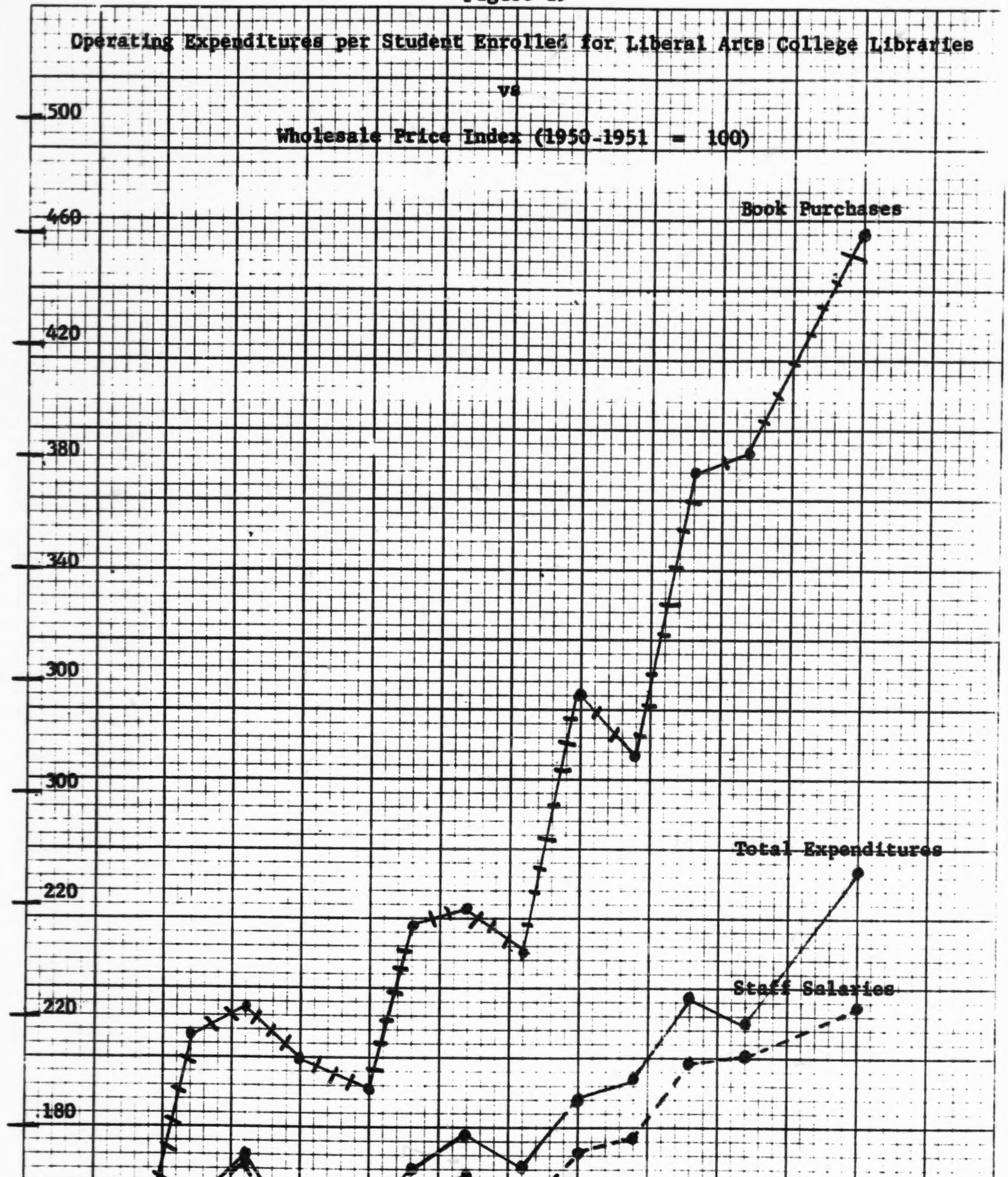
Source: See footnote to Table 3 .

Figure 19

Operating Expenditures per Student Enrolled for Liberal Arts College Libraries

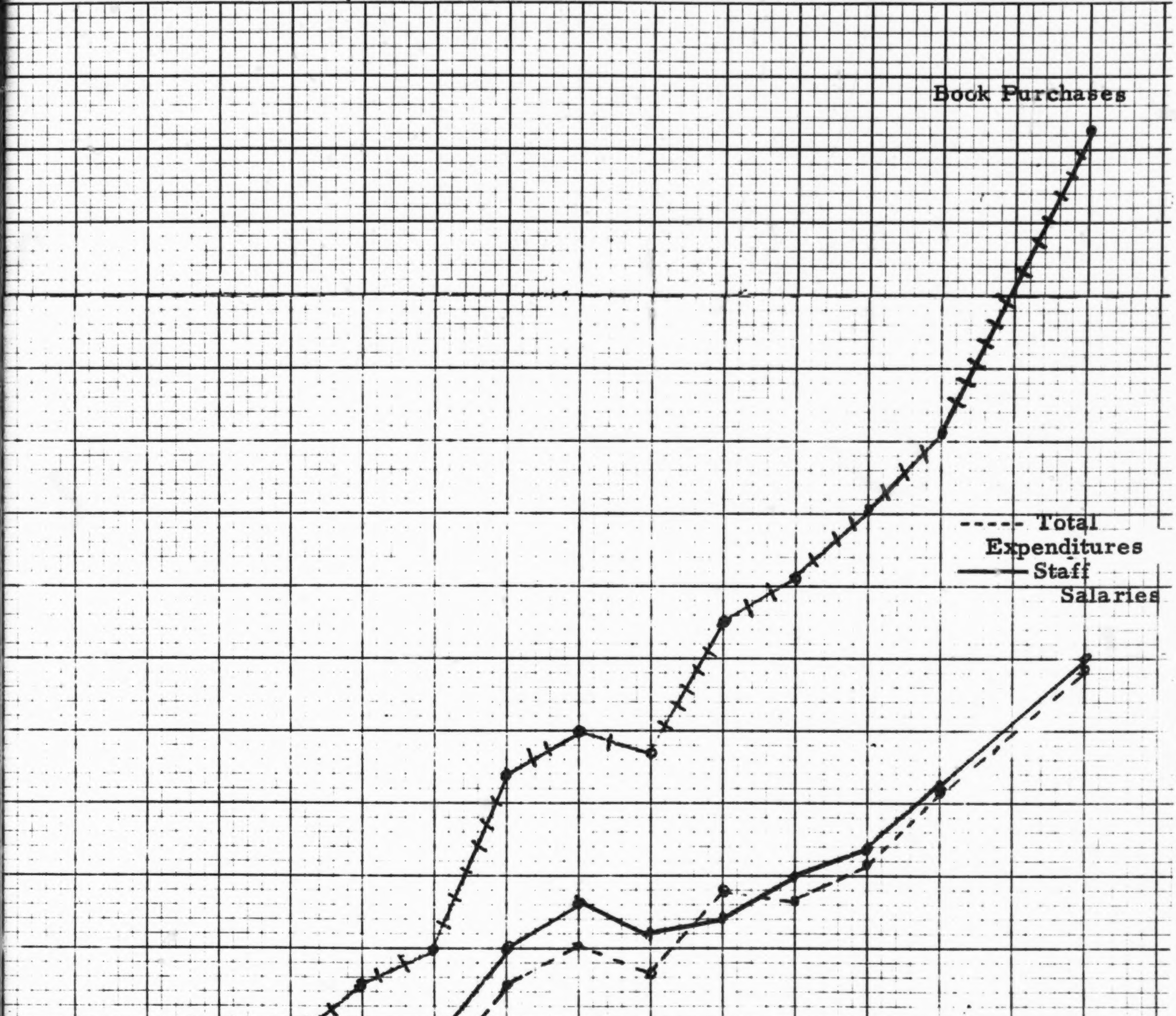
vs

Wholesale Price Index (1950-1951 = 100)

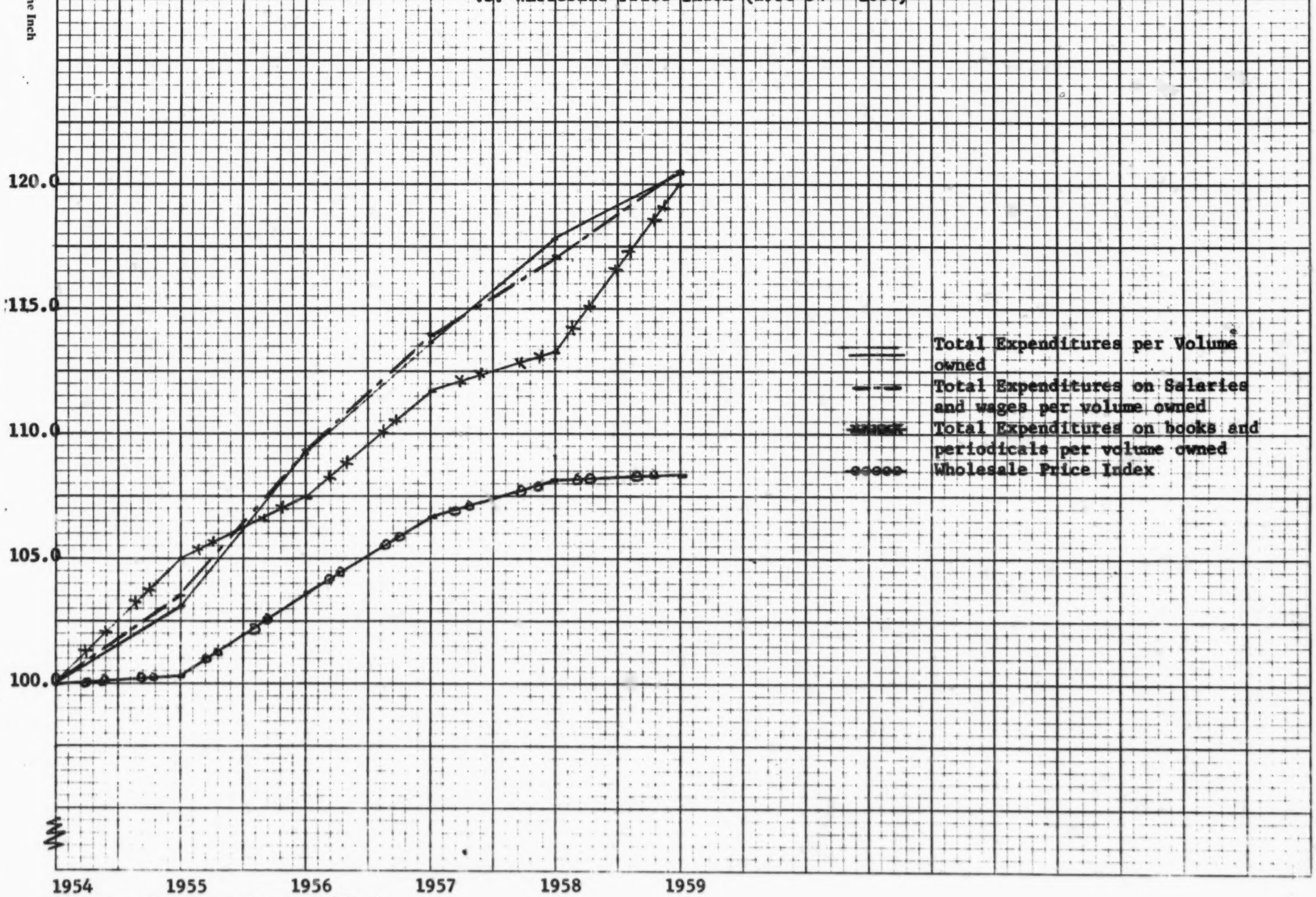


Source: See footnote to Table 3 .

Figure 20
Operating Expenses per Student Enrolled for
University Libraries vs. Wholesale Price Index (1950-51 = 100)



Operating Expenditures per Volume Owned for Public Libraries
Serving Cities with a Population of 50,000 or More
vs. Wholesale Price Index (1953-54 = 1000)



Source: See footnote to Table 1

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a measure of costs in the remainder of the economy. These figures show that the pattern of behavior is essentially the same for public libraries, for college libraries and for libraries at universities. The results do not change in essence when we take as the unit of output the number of students served, the number of volumes carried or the amount of circulation.

Figure 17, which depicts the per student operating expenditures of college and university libraries shows the typical pattern. This graph shows the behavior of costs per unit of service supplied here, in this case, we take the measure of service to be the number of students served. Subsequent figures in this set utilize alternative definitions of volume of service and report the results for some different classes of library to show the consistency of our findings for the various types of library.

Returning now to Figure 17, we see that it depicts for college and university libraries a total operating costs per student, staff salary costs per student, book purchase expenditures per student and the wholesale price index, all shown on the same diagram. The data are all recalculated on an index basis (1951 = 100), i.e., they are all rescaled to start off from a common point, the left hand end of the graph. If operating costs per unit had thereafter risen at the same rate as costs of commodities in the economy generally as indicated by the wholesale price index. The three library cost lines would have coincided with the wholesale price index line. What we see is that in fact per unit library operating costs rose far more rapidly than the price index. This is certainly true of staff salary expenditures per student, and new book purchase costs per student (upper line) have really risen phenomenally. The overall operating cost per student, which is a composite of staff and book costs, naturally rose at a rate intermediate between the two. This important graph leads to two significant conclusions.

1. While outlays on staff have risen, they have not gone up as rapidly as other operating costs and hence they only account for part of the increase in unit costs.

2. Library costs per unit have indeed gone up at a substantially faster rate than those in the economy as a whole.

Figure 18 shows the same results when costs are measured per volume carried, i.e., when the unit of service provided is defined in terms of the number of volumes available. Figures 19, 20, and 21 show that completely similar results hold for the Liberal Arts College libraries separately, for the university libraries separately, and for the public libraries serving cities with population over 50,000 (for the earlier period for which data are available).

Our results are also confirmed in Tables 9 and 10 which shows growth rates for library operating cost per unit of service and the comparable rates of increase in the wholesale price index. Table 9 shows, for example, that while the wholesale price index has been rising at a rate less than 1 per cent per annum, the operating cost per student in the college and university libraries has risen at the enormous compounded rate of 5.1 per cent per year!

It will be noted that for the college and university libraries these unit expenditure growth figures have all been of this substantial magnitude, ranging from 3.0 to

TABLE 9

Growth Rates in Per-Unit Operating Costs
College and University Libraries, Fiscal 1951-1966[18]

	Per Volume Owned	Per Volume Added	Per Student Enrolled
Total Expenditures	5.8%	3.6%	5.1%
	(.948)	(.928)	(.949)
Staff Salaries	5.3%	3.2%	4.7%
	(.959)	(.860)	(.931)
Student Salaries	5.2%	3.0%	4.5%
	(.949)	(.860)	(.934)
Books Purchased	9.0%	6.9%	8.3%
	(.986)	(.956)	(.966)

Wholesale Price
Index = 0.7%
(.759)

Source: See footnote to Table 3

[18] The growth rates have all been calculated by fitting logarithmic least squares regressions. The figures in parentheses are "standard errors" serving as measures of significance. All the figures are significant at the 1 percent level.

TABLE 10

Growth Rates in Unit Operating Costs in Public Libraries 1954-1959

	Total Expenditures	Per Volume Circulated	Per Volume Owned
Operating Expenditures	6.7%	1.8%	3.9%
	(.998)	(.986)	(.985)
Salary & Wage	6.6%	1.7%	3.8%
	(.998)	(.862)	(.985)
Book Exp.	6.2%	1.0%	3.4%
	(.992)	(.510)	(.977)

Wholesale Price
Index = 1.9%
(.934)

Source: See footnote to Table 1[illegible].

Table 10a

Growth Rates in Unit Operations Costs in College and University Libraries 1954-1959

	Per Volume Owned	Per Volume Added	Per Student Enrolled
Total Expenditures	5.6%	5.7%	5.0%
	(.894)	(.978)	(.731)
Staff Salaries	6.1%	6.1%	5.4%
	(.975)	(.971)	(.846)
Student Salaries	7.6%	7.6%	6.9%
	(.991)	(.907)	(.967)
Books Purchased	7.7%	7.8%	7.1%
	(.850)	(.948)	(.752)

Source: See footnote to Table 3.

9 per cent per year compounded.[19] The public library growth figures are somewhat lower, though still substantial, costs per volume carried rising at a little less than 4 per cent. The sole exception is represented by cost per volume circulated which, as a result of the rapid rise in circulation went up at a rate a bit below 2 per cent per annum, still not a totally negligible rise.

Part IV. Implications for Library Financing

1. Policies for Growing Costs: The Financial Requirements

One of the most immediate implications of the factual evidence and the analytic material which has just been presented is that the nation's libraries are going to require ever increasing amounts of financing. We have seen that costs per unit of library service can be expected to increase, year in-year out, relative to average costs elsewhere in the economy. This means that even if prices in the economy were to remain completely stationary and no improvement in library service and facilities were contemplated, library budgets would grow and grow ever higher.

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[19] Table 10b -- --shows growth rates for college and university libraries for 1954-59, the same period is that for which we have data for the public libraries. The growth rates range from 5 to 7 per cent per year.

But we do live in an inflationary world, and rising prices in the economy will necessarily add to the library's cost problems. Moreover, the knowledge explosion means that libraries must stock more and more volumes and somehow maintain their accessibility. The rise in the number of college and university students and the increase in the population generally means that more and more individuals will have to be served. All of this implies that library costs can be expected to grow even more rapidly than our basic analysis suggests.

Somehow, the funds to meet these rising demands will have to be found. If one is not to go from crisis to crisis, the financing of the libraries will have to be placed on a new footing with the anticipated rises in costs built into future budget projections. The experience of other services suggests that those who supply the funds tend to grow tired of recurrent emergencies which occur when actual expenditures exceed, time after time, the amounts that had been budgeted. Yet, in an activity in which constantly rising costs are unavoidable, unless these cost increases are planned for in advance, such financial emergencies are almost certain to recur.

Our analysis can help to provide a basis for re-education of the libraries' sources of support which must be undertaken if such problems are to be avoided in the long run. It will not be easy, but legislators, college and university administrators and others involved in the supply of library funds must be shown the nature of the long-run obligation they assume if they are unwilling to allow the nation's libraries to deteriorate. They must come to understand that cumulative rises in library costs are in the long-run unavoidable, so that no fixed level of support, however generous, will do the job for any protracted period. They must be shown that these rising costs are not a matter of inflation or the consequence of mismanagement or inefficiency. This is precisely why the technological basis of these cost increases has been emphasized so heavily.

In the endeavor to get this point across, at least one economic trend will facilitate the task of the libraries. As we have seen, the cost increases can be ascribed ultimately to rising productivity of manufacturing whose increasing efficiency renders the services ever more costly, at least in relative terms. It follows that the problem only arises as the economy as a whole grows more productive and hence wealthier. Thus, while the cost of maintaining the libraries can be expected to rise, the means to pay this cost can be expected to increase as well, since the former is, effectively, a consequence of the latter. With a growing national income, the community will surely prove more receptive to the rising financial needs of the library if the nature of these needs is explained effectively.

The statistical evidence on the prospects for support will be described presently, and the report will also discuss the grounds on which public support can be defended in terms of the social contribution of the libraries.

2. Grounds for Increasing Financial Support

It is generally taken for granted that support of the nation's libraries is a public responsibility and that governments and individual contributors together are morally obligated to supply whatever financing is necessary for their effective operation. The evidence that library costs are growing relative to costs in the remainder of the economy and that they are likely to continue to do so forces us to re-examine this matter. In effect, rising costs imply that the public is to be asked to assume a cumulatively growing obligation. But this suggests in turn that at some point the sources of support may become reluctant to meet the increasing bill unless the issue is faced squarely. Someone will have to make an effective case indicating the grounds on which the libraries merit this very demanding commitment.

This subject may seem a curious one for discussion in terms of economics. The contributions of the libraries to learning, to the arts, to scholarship and research all obviously seem beyond the powers of the measuring rod of money. These virtues are intangible and their values may well be considered to go beyond price. Yet any activity which lays claim to public funds does automatically raise an issue which ultimately is economic. For this claim is a demand that resources be transferred from other uses to the activity in question, from the production of factories or hospitals or opera houses to the construction of libraries, and, in principle, such a choice is no different from that which confronts a housewife when she considers the transfer of funds from the purchase of one sort of vegetable to another. In each of these decisions, rationality requires analysis in terms of the relative costs and the benefits which can be provided by the various alternatives.

It is a curious historical accident that libraries, museums and elementary schools have so long received the bulk of their financing from governmental sources while the nation's orchestras and many of its universities and its hospitals have been expected to rely for their financing on a combination of user fees and voluntary contributions. One may well ask whether there is any good ground for this distinction, or, more fundamentally, one may well inquire about the basis for the libraries' claim to any public support. Only by answering this basic question can one hope to make a really adequate case for the sort of commitment of public funds required by the libraries' rising costs.

Economists have, in fact, developed a very careful analysis of this sort of issue-- the rationale of government support. They have shown quite clearly what sorts of activity merit public funds and have demonstrated that the choice is not simply a matter of relative merit. It may be highly desirable for the public to obtain good food, good shoes and good soap as a means for personal sanitation, but no one suggests that the government should supply without cost all the food, the soap and the shoes that are acquired by individuals. Rather, it is felt that the supply of such items, important though they may be, can safely be left to the market test, that is, to provision by private enterprise which makes these commodities available only because their production yields a profit.

The reason the supply of such goods can be left to private firms is that the bulk of the benefits which they provide are available directly to the purchaser. The food which I consume offers little advantage to my neighbor. On the other hand, many other outputs are characterized by the very substantial benefits which they provide to persons other than the one who consumes them or which impose heavy costs on other individuals. My use of an automobile imposes significant social costs by adding to air pollution, to road crowding and contributing to the likely number of accidents involving others. On the other hand, education of the individual may provide benefits to society going well beyond those received by the student himself. Education is likely to increase his subsequent income, and thus provides him a very direct return. But in addition, education may well reduce the crime rate and may make for better citizens in a variety of other ways. Above all, it may make possible those additions to knowledge which have contributed alike to the nation's culture and to its material standards of living.

The economist has coined the term " externalities" to describe such indirect costs and benefits of a product which go beyond the individual who consumes it. An item which produces deleterious effects on persons other than its consumer is said to impose "external costs" whereas a good or service whose utility extends beyond its immediate user is said to supply "external benefits." It has been shown by economists that it is precisely those goods and services which yield externalities whose provision cannot legitimately be left subject to the market test.

The reason is not difficult to see. A commodity which imposes external costs is likely to be supplied to its consumer at a price below its social cost. When the manufacturer pays for the labor and metal that are required for the production of an automobile, his outlays include no component corresponding to the pollution and the other social costs that it will incur. He is, in effect, able to produce the car at bargain rates because he has shifted part of its costs to society. As a result, the profitability of automobile production to the manufacturer is no evidence of its profitability to society.

On the other hand, a service which yields external benefits, even if it clearly offers society good value for its money, may well be unable to pay its way. The reason is similar. If its consumer only receives a limited portion of the benefits that flow from the item, then the amount he is willing to pay for it can hardly serve as a measure of the social value of the commodity.

The preceding discussion at once provides the rationale for many types of current governmental activity. Pollution is an issue with which only governments can deal adequately because it is a manifestation of external costs, and its elimination therefore cannot be left to private enterprise. Similarly, the removal of slums has a legitimate claim on public funds, not merely as a charitable venture designed to rectify inequities in distribution, but also because, by providing better, safer and healthier neighborhoods, slum clearance offers (external) benefits to others in addition to their inhabitants.

It should be perfectly clear that libraries do make available a variety of external benefits. Their claim to public support rests therefore not on the desirability of their service *per se*, but, at least in part, on the external character of the benefits which they provide. If reading makes for better citizens, it is clear that the availability of libraries to the impecunious makes a social as well as an individual contribution. If libraries can help in the acquisition of skills which in turn contribute to the efficiency of the nation's productive process, then surely they provide yet another class of external benefit. Education has long been cited as a prime example of an activity which yields substantial external benefits, and the libraries, as a necessary instrument of the educational process, must, therefore, qualify correspondingly.

While the external benefits which they offer show conclusively that the libraries merit financing beyond that which is offered by the market place, the argument does not by itself justify the full extent of the support which will be required by cumulatively rising costs. It is however, not extremely difficult to deal with this issue in terms of material and tangible benefits alone. That is, one can argue that the economic external benefits alone may be adequate to justify public support of the libraries, so that their cultural and intellectual contribution can for these purposes be considered as a bonus offered to society as an addition to their economic yield.

The order of the economic contribution of the libraries can be estimated by considering what would happen to productivity and technological progress in their absence. It is surely no exaggeration to say that without libraries, or some very similar institution, education and research would be severely hampered if not substantially brought to a halt. In this sense, it can be maintained that the existence of our libraries has been a necessary condition for the rising per-capita incomes which have occurred through our economic history.[20] Without library facilities national income would surely grow far more slowly than it has. Since, moreover, the total increase in library costs is a negligible proportion of the growth in national income, it would indeed appear to be a foolish economy to fail to provide to the libraries the funds they will need to maintain the quality of their operations. These grounds then would seem to constitute full justification for the provision to the libraries of the growing public support which they will continue to require.

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[20] Here we refer of course to the basic research which has over the long-run offered such a rich yield of benefits to the economy, but whose problematic outcome and distant payoff has rendered it unattractive as a subject for financing by private enterprise. Some rather specialized company or industry libraries do play an important role in research and development, but these can derive much or all of their funding from the firms and industries that benefit from them.

Before concluding this section we may note one somewhat ironic result that follows from the analysis of this report. As we have just argued, the libraries constitute an element essential for the long run growth in productivity that characterizes our manufacturing sector. However, it has been seen that rise in manufacturing productivity is itself the reason for the cumulative increase in library costs that constitutes the library's basic financial problem. It follows therefore that the external benefits that constitute the libraries' most tangible and material benefit to society brings with it the most pressing economic problem that besets the libraries.

3. Prospects for Financial Support: The Role of Voluntary Contributions

As has already been indicated, libraries draw a relatively small portion of their financing from private contributors. This is obvious in the case of the public school libraries, and for the public libraries the situation is not much different. Table 11 reports for a number of years the sources of funds utilized by the public libraries located in continental United States. The 1962 figures which are probably the most reliable of these statistics indicate that only some $5.5 million out of the $360 million received by the libraries came from contributions and endowment together. That is, financing from private sources constituted less than 2 per cent of the total. Not only is this percentage small but, if the earlier data are to be believed, it has been declining over time. It has fallen from about 5.5 per cent in 1939 to a little over 4 per cent in 1956 and then[21] to its 2 per cent value in 1962.

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[21] These trend observations should not be taken too seriously. The post 1960 figures were put together more carefully than the earlier data and the sharp drop in the proportion of private contributions in 1962 may therefore simply reflect the change in statistical procedures rather than a variation on the underlying facts. There was also a temporary rise in this percentage from a little over four per cent in 1945 to nearly 5 per cent in 1950. However, the war years might well account for a drop in philanthropic contributions. In any event, the apparent decline in the proportion of funds from private sources may be ascribable in large part to the fact that endowment income is included in this category. The inflationary pressures of the postwar period have cut heavily into the purchasing power of many endowment funds and so a number of organizations in other fields have drawn a smaller and smaller proportion of their total incomes from their endowments.

TABLE 11

Receipts for Public Libraries for Continental United States

	1939	1945	1950	1956	1962
Total No. of Libraries Reporting	5,798	6,026	6,105	6,375	
No. of Libraries Reporting this item			5,685	6,190	
Total Receipts:	50,485,000	64,915,000	117,065,000	185,445,000	359,345,000
Local Appropriations	43,755,000	57,005,000	102,350,000	161,895,000	301,540,000
	86.7%	87.8%	87.4%	87.3%	83.9%
State Grants	275,000	955,000	1,955,000	4,975,000	26,385,000
	0.5%	1.5%	1.7%	2.7%	7.3%
Income from Endowments & gifts	2,775,000	2,645,000	5,695,000	7,910,000	5,505,000
	5.5%	4.1%	4.9%	4.3%	1.5%
Contract service (school & other)	480,000				5,475,000
	0.9%				1.5%
Undistributed Income	290,000	290,000	59,000		
	0.6%	0.4%	0.1%		
All other receipts	2,910,000	4,025,000	7,005,000	10,665,000	11,010,000
	5.8%	6.2%	6.0%	5.7%	3.1%
					7,430,000 Excluding Fines & Fees
					2.1%

Note the pre-1962 figures were not done on a sampling basis. Furthermore, when a library did not report a cost, zero was averaged into the aggregate cost figure.

Source: U.S. Office of Education, Statistics of Public Libraries, issued approximately every five years.

Nevertheless, voluntary contributions are of some importance to the libraries. They are of potential significance to the public libraries because, if these institutions find themselves under rising financial pressures as a result of cost increases, they may be forced to turn once again to the individual donor. The private libraries are, of course, heavily dependent on private contributions. But the primary significance of this source of funds is an indirect one. Since the nation's private colleges and universities are among the leading sponsors of library activity, the dependence of these institutions upon this type of financing automatically affects the libraries at second remove.

What then are the prospects for private philanthropy, and what trends have been observed in the recent past? It has been estimated that individual philanthropic contributions in the United States have risen from some 1.5 per cent of Adjusted Gross Income[22] in the prewar period to nearly 2.5 per cent after the war.[23] The most striking increases in total philanthropic contributions occurred between 1950 and 1954 when the limit on tax deductions for contributions was increased (to 20 per cent in 1952 and then, under certain conditions, to 30 per cent in 1954). Their total amount has risen more than tenfold from an estimated $973 million in 1924 to over $9800 million in 1962. Of course, inflation accounts for a considerable proportion of this increase but even if one were to correct for changes in purchasing power of the dollar the change would still be impressive. In terms of 1924 dollars, the 1962 figure[24] is $4, 741 million so that the real purchasing power of contributions has increased nearly fivefold over the course of the less than four decades.

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[22] The Adjusted Gross Income of all individuals is their total gross income less business deductions as reported for tax purposes. See Harry Kahn, Personal Deductions in the Federal Income Tax, Princeton University Press, Princeton, 1960, pp. 8-9, 17.

[23] This and a number of the figures that follow, are taken from W. J. Baumol, and W. G. Bowen, Performing Arts: The Economic Dilemma, Twentieth Century Fund, 1966, Chapters XIII and XVII.

A very considerable proportion of these contributions however, (61 per cent of all itemized contributions in 1962) went to religious activities. The bulk of the funds going to that class of recipient came from lower income classes-- over 60 per cent of the gifts to religious institutions

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[24] 1924 prices were calculated by dividing 1962 prices by the 1924 price deflator, i.e.,

$$\text{1924 price} = \frac{\text{1962 price}}{\text{1924 price deflator}}$$

The 1924 price deflator was calculated from the GNP in 1958 dollars and the GNP in current dollars, as found in Long Term Economic Growth, U. S. Department of Commerce, Bureau of the Census, p. 166.

in 1960 was provided by donors reporting annual incomes under $10,000. The preponderant part of the funds provided to higher education, and hence, presumably, to libraries, came from higher income groups. Thus, in 1962, 23 per cent of all contributions to educational institutions was provided by the relatively small class of persons whose family income was between $100,000 and $499,999, and about half the contribution to education came from the class of persons earning over $50,000 per annum!

In total, in recent years contributions by higher income groups of individuals (which we arbitrarily define as the top 20 per cent of the nation's families in terms of total personal income) has been rising at a compounded rate somewhere between 4 and 6 per cent per annum. However, contributions to higher education have risen somewhat more rapidly as a result of the very carefully conceived and effectively executed fund raising activities of the nation's educational institutions. One estimate suggests that, at least for several years, these contributions rose at a compound rate of 15 per cent per annum[25] though subsequent investigation suggests that this figure is somewhat inflated.

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[25] Council for Financial Aid to Education, Guide Lines to Voluntary Support of America's Colleges and Universities, New York, p. 22 (no date).

At any rate, it is clear that private contributions have been growing and growing rapidly. Certainly, if they were to continue to expand as rapidly as the postwar growth rate in giving to colleges and universities, this source of funds should, other things being equal, be able to help significantly toward meeting the rising costs of library operation.

Unfortunately, however, there is another side to the story. First of all, there is some evidence that total contributions and, in particular, the contributions of the upper income groups, have been leveling off. Estimated overall philanthropic contributions as a per cent of adjusted gross income rose from 2.48 per cent in 1956 to 2.50 in 1958 to 2.54 in 1960 and then fell to 2.51 in 1962. Over the period 1954-62, the top 20 per cent of income earners increased their contributions at an average annual rate of 5.8 per cent. But, if we perform the same calculation for the slightly later period, 1958-62, this figure falls to 3.8 per cent per annum, a much slower rate of growth. In part this suggests that there may simply be a limit to the proportion of their incomes that people are willing to give away. It may also reflect the fact that there have been no major recent increases in exemptions for charitable contributions. In any event, there is some evidence to suggest that current exemptions are so liberal that further increases might be of very little help.[26] Thus, while voluntary contributions to education and to other related activities may perhaps continue to increase as rapidly as they did in the past, one cannot count on it with any degree of assurance.

There is also a second caveat that is relevant in this connection. The availability of library funds from colleges and universities depends not only on the monies received by these institutions, it is also affected materially by the competing demands of other college and university activities. Here there arises another problem. The costs of higher education have risen at a spectacular rate over the postwar period. A variety of reasons can be cited to account for this--the upsurge in the number of students, the increasing complexity of research equipment, etc. In addition, higher education obviously suffers from the limited opportunities for increases in productivity which also lie at the root of the financial pressures that beset the libraries. Consequently cost per student has been estimated to have increased after the postwar period at an annual rate of nearly 7 per cent per annum. If we combine these influences, it is not difficult to show that outlays in higher education threaten to outrun significantly the growth in private contributions. This clearly means that the libraries as claimants on the general budgets of the private colleges and universities cannot anticipate an easy time in obtaining increasing amounts of money from this source.

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[26] See Kahn, op. cit., pp. 56-91.

4. Revenues from Municipal Sources

Municipal and local governments play an extremely important role in the financing of library services. Since local governments provide so high a proportion of the financing of the public schools, it is clear that the public school libraries are highly dependent on them for funds. The public libraries too, derive the bulk of their resources from them. As shown in Table 11, over 85 per cent of public library funds is derived from local appropriations and there is no discernible trend in this figure.

Yet while the municipalities loom large in the financing of the libraries the reverse is not true-- the libraries constitute a minuscule proportion of the expenditures of the local governments. For example, in 1962 a breakdown of public expenditures of U. S. standard metropolitan areas [27] which listed items constituting as little as 3 per cent of the budget leaves library expenditures over for the miscellaneous category.

Since 1939, when the public libraries derived some 44 million dollars from local appropriations, the amount received from this source has increased nearly sevenfold to about 302 millions in 1962, and it has almost certainly gone up further since that time. Again, there is some question about the reliability of the earlier figures but there is no reason to doubt their direction.

The critical issue, however, is whether the municipalities can be expected to continue to keep up with the needs of the public libraries. Here there is little question about the good intentions of the local governments, but as the reader is doubtless aware, in recent years the municipalities have encountered a variety of financial difficulties. On the revenue side, for a number of reasons, they have had some problem in increasing tax revenues: first, their revenues are limited by the fact that the taxes collected by the local governments are characteristically not what the economist calls " highly income elastic." As local per-capita incomes rise, the tax receipts do not tend to increase correspondingly. With their heavy reliance on property and sales taxes, neither of which is progressive, municipal tax receipts are less responsive to income increases than is a straight-forward income tax under whose provisions tax payments usually go up, automatically, more than in proportion to rising incomes.

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[27] See George F. Break, Intergovernmental Fiscal Relations in the United States, The Brookings Institution, Washington , D. C., 1967, p. 170.

Second, with the exodus of the middle classes to the suburbs, the urban municipalities have found that they have not shared fully in the rising incomes that have characterized the United States as a whole, and so their tax base--the source from which the cities derive their tax funds, has tended to lag behind. Third, municipalities have been reluctant to raise their tax rates or to impose new taxes, for fear of driving industry and wealthier residents into other locations. As a result local governments have tended to compete with one another in their resistance to new revenue measures. Finally, the municipalities have found that, where their proposed tax increases require authorization by the states, the state governments have often been niggardly in granting permission for such supplementary revenue measures. On all four counts, then, the local governments have encountered difficulties in expanding the flow of revenues out of which their expenditures are financed.

While the municipalities have for these reasons run into trouble in trying to increase their revenues their costs have refused to stand still. In large part this cost pattern can also be ascribed to the labor intensive character of a considerable variety of urban services. Education, police protection, hospital care and a variety of other municipal services run into technological problems in increasing productivity of exactly the same variety as those that beset the libraries. For example, this is clearly true of education which in 1962 took up [illegible] per cent of the outlays of the U. S. standard metropolitan areas.[28] Yet as is shown in Table 12,

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[28] Break, loc. cit.

Table 12

Current Costs per Pupil-Day in U. S. Public Schools

1900	$ .12	1952	$ 1.38
		1953	1.35
1910	.18	1954	1.48
		1955	1.51
1920	.33	1956	1.71
		1957	1.69
1930	.50	1958	1.85
		1959	1.94
1940	.50	1960	2.13
1946	.77	1961	2.20
1947	.86	1962	2.37
1948	1.02	1963	2.42
1949	1.09	1964	2.57
1950	1.18	1965	2.70
1951	1.26	1966	2.93
		1967	3.15

Annual Rate of Increase (Compounded):

1900 - 1967	5.0%
1947 - 1967	6.7%

Source: These figures were calculated by multiplying average daily school attendance for each year times the average number of days in the school year to give a number of pupil days figure. This last number was then divided into the annual current expenditure on public elementary and secondary education to give the current cost per pupil day. The sources of the data for these calculations are Status and Trends: Vital Statistics, Education, and Public Finance, Research Division, National Education Association, Report R13, August 1959, p. 22; and Estimates of School Statistics, 1966-67, Research Division, National Education Association, Report R20, 1966, pp. 11, 20. Data interpolations were used for some years.

costs per pupil-day have risen nearly tenfold between 1920 and 1967. In the postwar period (1947-67) this figure increased at the astonishing rate of 6.7 per cent per year, thus nearly doubling every decade, while the wholesale price index was rising at the rate of only 1.4 per cent per year on the average of about 28 students per class in 1947 to an average of 25.4 students per class in 1966. But this change accounts for only a small proportion of the enormous rate of increase in cost per student-day. Add to this the postwar rise in student population and we can see why educational costs have constituted so rapidly increasing a burden in the municipalities.

Other municipal services can be shown to be subject to similar productivity problems and hence to have been characterized by the same sorts of cost increases. There is no point in providing any further illustrative documentation. The facts of the matter are clear--municipal costs have been rising at a phenomenal rate and since technology accounts for a considerable proportion of these increases there is no ground on which to expect any substantial decline in their rate of growth in the future.

The moral of all this is clear. The municipalities are likely for the foreseeable future to continue to grow less and less generous in meeting the financial needs of the activities which in the past have been largely dependent upon them. Rapidly rising costs and inability to increase revenues at will are likely to continue to force local governments to be more niggardly in the financing of their services. Outlays will no doubt go up but perhaps not as rapidly as is required to meet rising costs. They will find it ever more difficult to satisfy the ambitions of those who provide the services--their desire to offer ever better service in terms of the quality of the product and the number of persons who receive it. All of this does not bode well for the public libraries. While up to this point, as we have seen, the share of local financing in their budget has remained relatively constant, they should begin to plan for the possibility that monies from this source will in the future not rise as rapidly as the amounts that may be considered necessary.

Perhaps the financial problems which this suggests will in fact never materialize. Particularly this may be so if the federal government implements on generous terms some of the proposals for revenue sharing whereby some of the federal revenues would be returned to the states and through them to the local governments. But revenue sharing is still a long way from enactment, and, in any event, prudence requires that the public libraries be prepared for the eventuality that the municipal budgets will no longer prove adequate for their needs.

That being the case, one must look to the source whose ultimate prospects are most promising--to the federal government, as a potential patron of the libraries.

5. Federal Funding of the Libraries

The following section on the federal funding of libraries is not meant to provide a penetrating look into the complexity of the relationship between the federal government and the nation's libraries. Its purpose is to provide a brief and superficial overview of the federal government's activities in this area and to illustrate the point that the provision of resources to the libraries by the federal government has increased considerably in the past few years.

Federal funds are now available for the construction of facilities, for the training of librarians, acquisition of library materials, cataloguing and bibliographical work, inter-library arrangements and aid for technological experimentation.

A. The Library Services and Construction Act.[29] Federal funding of libraries was not introduced, in any significant amount, until 1956. At that time, the rural Library Services Act was passed and put into effect. The act, which applies only to public libraries, authorized a maximum annual appropriation of $ 7. 5 million for five years to be used to stimulate the further development of public library services in rural areas with populations under 10, 000. Under its provisions funds were allotted to each state on the basis of its rural population, and matched by the states, on the basis of their per capita income. Funds could be used for salaries, books and other library materials, library equipment and other operating expenses, but they could not be used for the purchase of land, or the purchase or erection of buildings. This act was the first aimed directly at the establishment, improvement and extension of public library services.

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[29] John Frantz and Nathan Cohen, "The Federal Government and Public Libraries: A Ten-Year Partnership Fiscal Years 1957-1966" U.S. Department of Health, Education, and Welfare, Office of Education.

The act was extended in 1960, and it has been estimated that as a result state expenditures in local libraries rose 135 per cent and local funding rose about 115 per cent from its 1956 level. In 1964,"The Library Services and Construction Act amended the original rural program legislation to include authorization for grants for public library services to urban as well as rural areas and funds for public library construction. An appropriation of $ 55 million under the Act was made by the Congress for each fiscal year, 1965 and 1966: $25 million for Title I, Services, and $ 30 million for Title II, Construction. To ensure that federal funds do not replace state and local funds, state and local expenditures for public library service cannot fall below those for the 1963 "floor" year."[30] Subsequent authorization has provided $ 192 million for fiscal 1971. Thus, the amounts authorized have gone up to more than 25 times the original $ 7. 5 million over the fifteen year period, fiscal 1957-71.

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[30] Ibid., pp. 2-3.

For 1967, under this act the following amounts were authorized or appropriated for the purposes specified.

Title I: For general library services in areas without service or inadequate service, $ 35 million was authorized and appropriated, with the federal share of expenditures specified to constitute between 33 and 66 per cent of the total.

Title II: For library construction in areas without library facilities to develop services, $ 40 million was authorized and appropriated, with the federal share as in Title 1.

Title III: For assistance in interlibrary cooperation $ 5 million was authorized but only $ 375 thousand appropriated, without state or local matching fund required for the year.

Title IV: For library services to institutionalized persons and the physically handicapped $ 8 million was authorized, only $ 625 thousand appropriated and no state or local matching was required.

"The Library Services Act and Library Services and Construction Act have provided a great stimulus to the growth and improvement of public libraries during the past decade. A total of $ 159 million in federal funds has been expended for both library services and construction during the ten-year program. About $ 600 million are currently being expended for public library services and construction from federal, state, and local sources."[31]

B. The Elementary and Secondary Education Act.[32]

Other pieces of legislation of significance for the libraries include the Elementary and Secondary Education Act of 1965 (which helped public school libraries primarily) the Higher Education Act of 1965 (which applies primarily to college and university libraries) and the National Defense Education Act of 1958.

The Elementary and Secondary Education Act of 1965 is oriented heavily toward assistance of educationally deprived children, and provides federal help for the improvement in quality of education and educational opportunities in public and private elementary and secondary schools. Under Title I of the act assistance is offered to deprived children between the ages of 5 and 17 years who are handicapped by poverty, neglect, delinquency or cultural or linguistic isolation. With some special provisions to assure the separation of church and state, some benefits are also extended to students in non-public schools.

For school libraries in low income areas Title I permits assistance for the purchase of books, periodicals, equipment, and the hiring of staff.

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[31] *Ibid.*, p. 13. The source goes on to state "Almost $ 2 billion more are needed to bring public libraries up to a minimal level of adequacy so that they may fulfill their vital role as 'The University of the People' for all Americans."

[32] The information concerning Title I of this Act has been read and corrected by Mr. John Hughes, Administrator of Title I of the Elementary and Secondary Education Act. The information concerning Title II has been approved by Dr. Margery Johnson, Administrator of Title II of the Elementary and Secondary Education Act.

During fiscal 1967 under this act $ 1,053 million was appropriated for the education of the disadvantaged. How much of this amount was devoted to libraries and related activities is not known. However it has been suggested that the amount was substantial, improvement of library facilities being a fairly obvious and direct use of such funds.

Under Title II of the act which provides funds for textbooks, school library resources, and miscellaneous instructional materials, $ 100 million was appropriated in fiscal 1966. For 1967 $ 105 million was appropriated, though only some $102 million dollars was allocated. An allocation of $105 million is anticipated for fiscal 1968.

C. The Higher Education Act.[33]

Title II of the Higher Education Act of 1965 was designed to provide assistance directly to college and university libraries. Title II consists of three parts.

Part A provides funds for basic grants, supplemental grants and special purpose grants to be used for the purpose of buying books, periodicals and other library materials and for necessary binding. Under Part A a total of $ 50 million was authorized for the fiscal years 1966-68. $ 10 million has been appropriated for fiscal 1966 and $ 25 million for fiscal 1967. There has been no appropriation for fiscal 1968. Basic grants are limited to $ 5,000 for each institution, or branch of an institution, given only on the condition that the institution does not decrease the amount theretofore expended for library purposes, and that it must at least match the amount of the grant. Special purpose grants may be made to libraries showing special need.

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[33] Paxton P. Price, Acting Chief of College Resources, Division of Library Services, U. S. Office of Education, has given his approval to the following discussion of the Higher Education Act.

Part B authorizes the Commissioner of Education to make grants to institutions of higher learning to cover the costs of training of librarians or for scholarships for library trainees. In addition, he may make grants for research and demonstration projects for the improvement of libraries or training in librarianship. Under Part B, $ 15 million was authorized for both library training, and research and demonstration for 1966-68. In fiscal 1966, $ 1 million was appropriated for library training, but there was no appropriation for library research and demonstration. In fiscal 1967 $ 3,750,000 has been appropriated for library training, and $ 3,550,000 for library research and demonstration. As of July 10 there has been no appropriation for fiscal 1968.

Under Part C of Title II of the Higher Education Act, the Commissioner is to "transfer funds" to the Library of Congress for acquiring library materials published throughout the world and providing catalogue information to libraries.

D. The National Defense Education Act.[34]

The National Defense Education Act of 1958 was not specifically directed to the provision of increased library facilities. Nevertheless,three of its titles provide sources of funds for research libraries.

Title III, as revised in 1965 provides federal matching grants to states to institute programs, and to strengthen instruction in public, elementary and secondary schools. Projects may include acquisition of laboratory and other special equipment, such as audio-visual materials and equipment, and printed and published materials (other than textbooks) suitable for use in providing education in the critical subjects. (For fiscal 1968 the Act authorized an expenditure of $ 110,000,000 for Title III, but the House-passed allowance for fiscal 1968 was $ 50,000,000.)

Title VII (A) grants the Commissioner of Education authority to further research and experimentation in the various media of communication. Under Title VII (B) he is authorized to "prepare and publish... such materials as are generally useful in the encouragement and more effective use of those media."

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[34] The following information on the National Defense Education has received the approval of Dr. Margery Johnson, Bureau of Elementary and Secondary Education Act.

Title IX provides the National Science Foundation with the right to establish a Science Information Service which would aid in the dissemination of scientific information and develop technological improvements in this area.

In addition to what has just been described the government has provided some indirect assistance which the legislation referring directly to libraries does not encompass. Through its general assistance to elementary and higher education the federal government has surely released school funds for use by the libraries, funds which might otherwise have been required for other purposes. There have also been some small unrestricted grants emanating from agencies such as the National Science Foundation which have been used in part to assist the libraries.

We conclude from the preceding discussion that from its modest beginning only a little more than a decade ago federal aid to libraries has risen at an enormous rate. From an initial $ 7. 5 million per annum in 1956 total federal funds to libraries of all sorts has risen to well over $ 100 million in 1966. This rate of increase obviously bodes well for the future and suggests that the federal government has not shirked its responsibilities to the libraries.

Political prospects for future funding by the federal government are always difficult to evaluate particularly since they depend so heavily on political vicissitudes and on the nation's military commitments. But it is clear that in the long run the libraries are likely to look more and more to Washington as a major source of financing. Without growing federal aid the libraries are likely to run into serious financial problems as a result of their rising costs and the financial pressures which beset their alternative sources of support. Because of their obvious importance for the nation's educational and research activity, and because of the relative modesty of their needs in comparison with those of many other claimants upon the resources of the federal government it is difficult to believe that their requirements will not be met.

Part V. Alternatives for Library Operation

1. Economies of Scale

The funding of the libraries does not, of course, constitute the only economic issue that they face. Alternative modes of library operation are, in part, economic matters.

If pressures on library funds do, in fact, increase materially, it may prove necessary to undertake new modes of operation that promise to be more economical. And, in any event, where economies can be instituted without any significant deterioration in standards, they may release funds which the libraries can put to very good alternative uses. Economies then may constitute a prime candidate as the source of financing for the library's future activity goals.

Consequently, we turn now to some of the alternative modes of library operation, and seek to evaluate so far as possible, in light of the available data, their financial implications. The next few sections are intended to deal with the issues arising out of the possibilities for automation describing some of the specific technological changes that are in prospect and suggesting the economist's view of their potential role.

In this section our attention will be concentrated on the possibility of economies of large scale operation in the library. In industry, economies of scale have constituted a prime ingredient in technological progress. The assembly line, that ultimate exemplification of what the Englishman calls "industrial rationalization," is clearly made possible by large-scale operation. No minuscule firm could possibly specialize its manufacturing sub-activities in a manner that renders feasible the assembly procedure. Many other economies have also proved to be available to industry only when the pertinent activity was carried out at a very substantial level. Small firms, for example, have found the opportunities for the use of computers to be far more limited than have the giants of industry.

In libraries, economies of scale, if they exist, must clearly take a more subtle form. Happily no assembly line is in prospect for the operations of a library. Yet the issue of economies of scale is highly pertinent because it can play a critical role in the organization of library activity. In particular, it is important for matters relating to the choice between centralization and decentralization, for if economies of scale were to prove very substantial it would mean that much could be saved by the operation of a few large central libraries as a substitute for a larger number of localized establishments. For a variety of reasons one might still prefer a considerable degree of localization; for example, the neighborhood public library may have no effective substitutes in impoverished areas-- but at least one would have to recognize that such a decision incurs a very substantial cost.

The evidence on the subject is fairly clear-cut. It suggests quite categorically that larger libraries do operate more economically, though the differences in cost of operation are not enormous. That is to say, the evidence is all quite consistent, indicating beyond reasonable doubt that the larger library can serve a given reader's needs more economically. But while some money can be saved by increased centralization, the amount is apparently fairly modest.

Table 13 is one of the most convincing pieces of evidence on this matter. It is based on the experience of libraries serving populations varying considerably in size. The table describes the variation in cost corresponding to libraries serving different populations ranging from less than 10,000 to over half a million inhabitants. This table seems to suggest not only that economies of scale are present

Table 13[35]

Experience Formulas for Library Size and Costs

Pop. Size	Book Stock per capita	Seats per 1,000 pop.	Circulation per capita	Total sq. ft. per capita	Desirable 1st floor sq. ft. per capita	1961 est. cost per capita[28]	Cost per unit circulation
Under 10,000	3 1/2 - 5	10	10	.7 - .8	.5 - .7	$ 15	$ 1.50
10 - 35	2 3/4 - 3	5	9 1/2	.6 - .65	.4 - .45	12	1.30
35 - 100	2 1/2 - 2 3/4	3	9	.5 - .6	.25 - .3	10	1.10
100 - 200	1 3/4 - 2	2	8	.4 - .5	.15 - .2	9	1.10
200 - 500	1 1/2	1 1/4	7	.35 - .4	.1 - .125	7	1.00
500 + over	1 - 1 1/4	1	6 1/2	.3	.06 - .08	6	0.90

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[35] Without furnishings (add 15%) or air-conditioning (add 10%). These figures originally based on 1940 conditions, now increased to reflect larger book stocks. Floor-space reduced because of economies.

Source: Wheeler, Joseph L. and Goldhor, Herbert, Practical Administration of Public Libraries, Hayser and Row, 1962, p. 554.

but it would appear to show also that they are very considerable in magnitude. The cost per-capita falls quite steadily from $15 for libraries serving populations under 10,000 to $6 for populations of half a million and over. These results may, however, reflect a relatively better provision of facilities for smaller populations, and a higher level of activity in the smaller population units. Thus, for example, in the smaller communities the book stock per-capita ranges from 3.5 to 5 and the square footage per-capita runs to 0.7 to 0.8 while in the largest communities the corresponding figures are 1 to 1.25 volumes and 0.3 square feet per-capita. One might argue, however, that this is an unavoidable concomitant of the operation of any sort of effective library. That is to say, even in a very small town, a library with less than 10,000 volumes simply might not offer a reasonable level of selection on any criterion and so, merely in order to provide effective library service it must offer more volumes per-capita than does a library in a larger metropolis.

Conclusive evidence that Table 13 does somewhat exaggerate the scope for economies of scale is offered by the fourth column of the table which shows that circulation per-capita rises from 6.5 in the largest communities to 10 in the smallest. Whatever may be the reason, then, apparently circulation is significantly greater in small town libraries than it is in large cities. As a result, while total library costs per-capita are much larger in small communities,it is clear that the cost per unit of circulation falls much more slowly. As the last column of Table 13 shows, cost per book circulated rises from a little under $1,00 in libraries serving populations of five hundred thousand and over, to $1.50 per volume in libraries in communities of less than 10,000 persons.

Figures 22 and 23 show how the amount of labor employed and the number of volumes carried vary in relation to the library's total circulation.[36]

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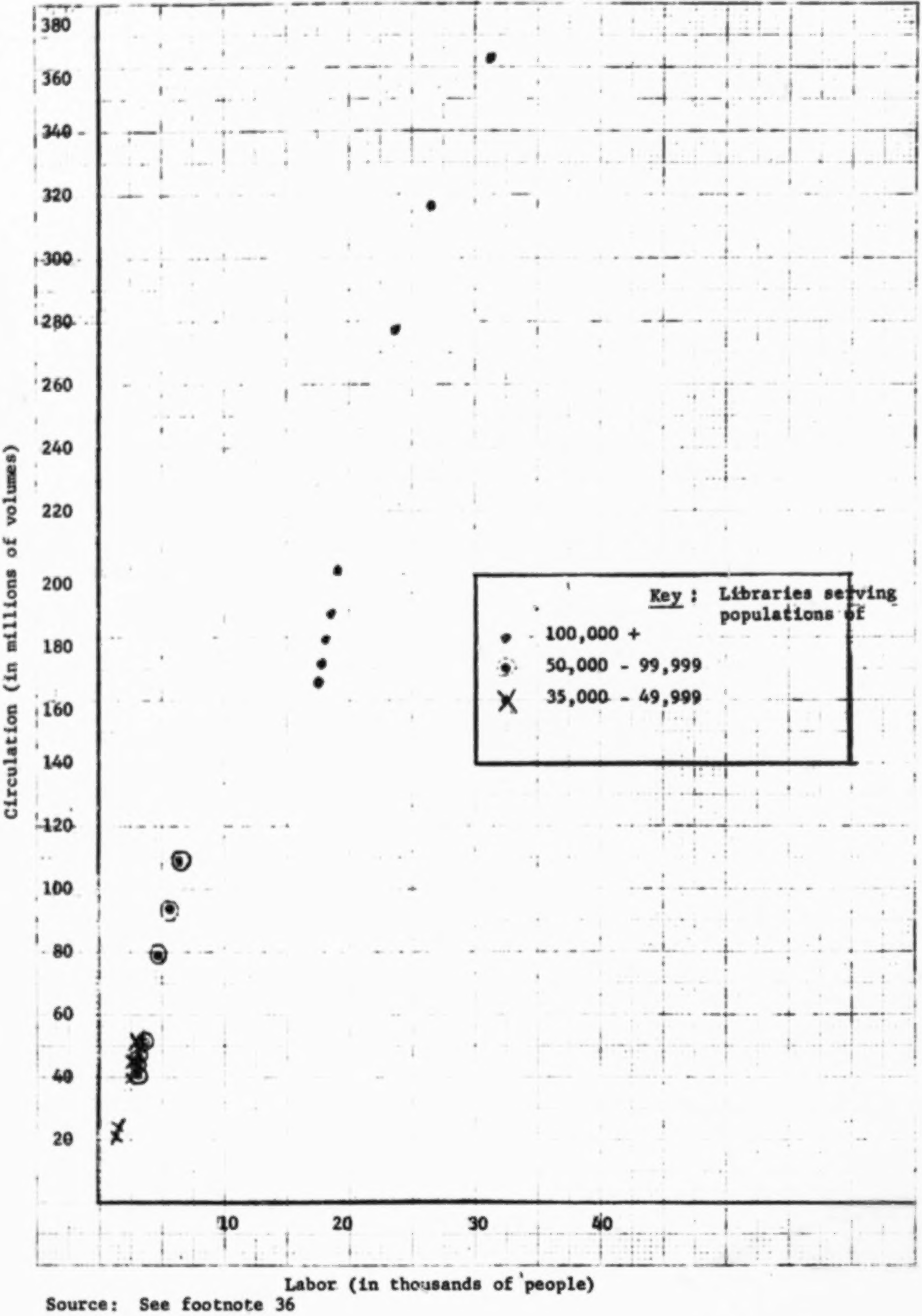
[36] These data are from the Office of Education's Annual Surveys of Public Libraries serving cities of varying populations. For each city size grouping, the graphs show total circulation for all libraries reporting in the group against total book stock and total number of employees. The years included are 1954 to 1962 for libraries serving cities of 100,000 and over, and fewer years for the smaller size groupings. There is a change in the classifications in 1959.

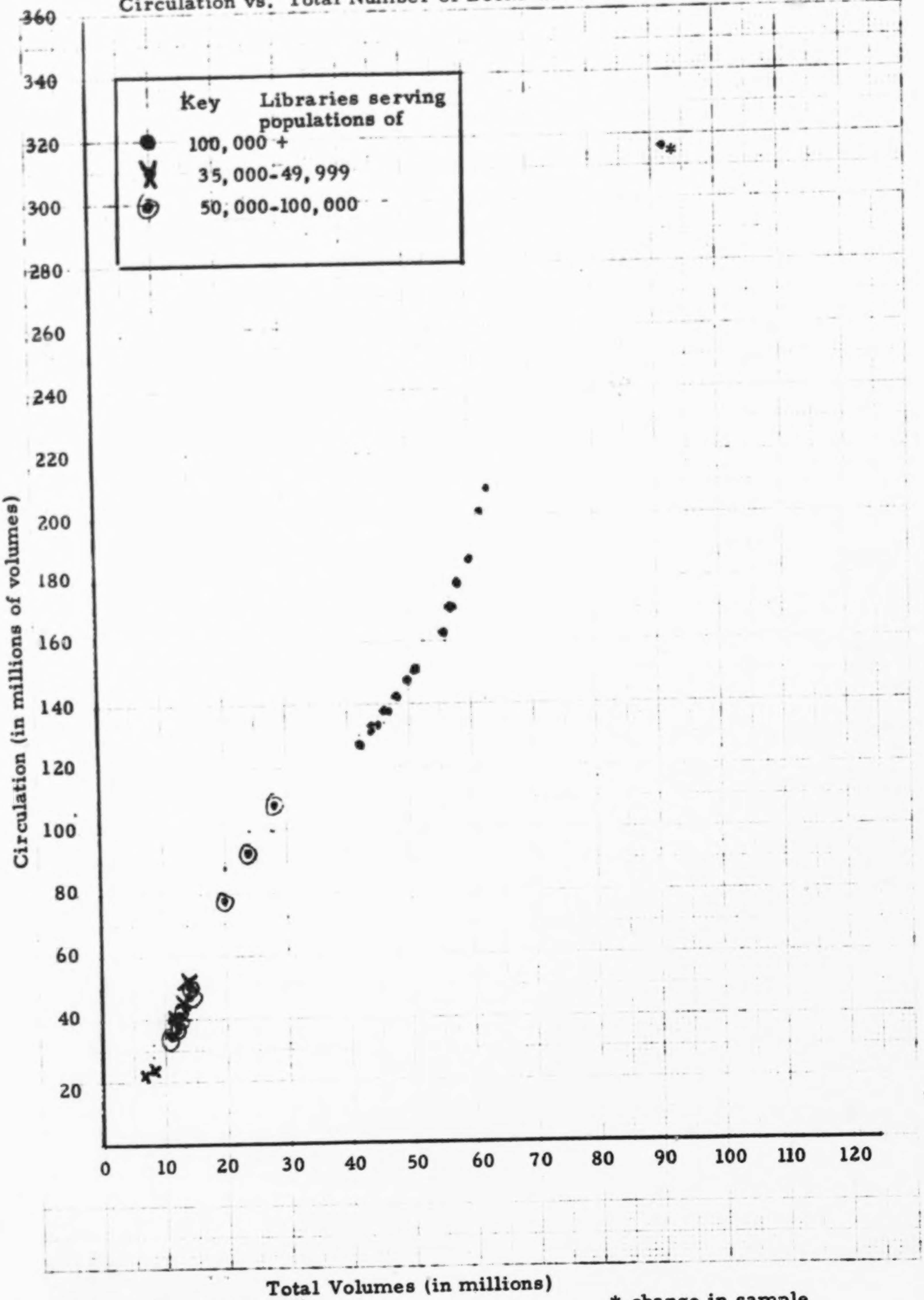
Figure 22
Circulation vs. Labor Used in Public Libraries



Source: See footnote 36

Figure 23

Circulation vs. Total Number of Books in Public Libraries



* change in sample

Source: See footnote 36.

These graphs indicate that circulation requires just about proportionate increases in the amount of labor utilized and in the number of volumes carried. In other words, they suggest that if there are economies of scale they are probably not very large. It should be emphasized that Figures 22 and 23 are not based on the data which underlie Table 13. Table 13 refers to the costs of libraries of different size in one given year, while Figures 22 and 23 report the costs of a given body of libraries as they expand their activities with the passage of time. As a result they should not necessarily appear to suggest the same conclusions about economies. For example, it might transpire that a given library only learns slowly to take advantage of the best available technology for its size as the scale of its operations increases so that a newly expanded library would then offer economies smaller in magnitude than those provided by one which has long been large. Nevertheless, further analysis suggests that these figures are not inconsistent with the results of Table 13. We find, examining the intertemporal figures more carefully, that over the period 1954 to 1959 the average annual rate of increase of circulation in libraries serving populations of 50,000 and over has been 5 per cent per year. Yet over the same period the number of books carried by these libraries has grown at an average of only 2.8 per cent per year (see Appendix B). Clearly, these results, which show that circulation can expand nearly twice as quickly as the number of volumes carried or as the amount of labor utilized, suggest that economies of scale are indeed a very real phenomenon.

All of this indicates that one large library can operate more inexpensively than two small ones. This observation is not meant to suggest that all small libraries should be abolished forthwith or that amalgamation should be the watchword of all future library operation. It implies merely that if one chooses to expand the number of small libraries or even to retain their number, it must be recognized that this is not a costless decision, and so, such a policy must be justified in terms of commensurate prospective benefits.

2. Digression; Labor - Book Ratios in Library Operation

While discussing the relationship between scale of operation and cost it is natural to inquire into the effect of level of activity between inputs and outputs. While this is essentially a digression we shall deal briefly with this issue. Yet the brevity of our discussion should not be taken as an index of its potential importance because on this sort of information one may be able to base an analysis making possible substantial efficiencies through improvement in the proportions of inputs utilized.

The two prime inputs to library operation are ultimately the efforts of the library staff and the books held by the library. Figure 24 relates[37] the number of books held by a library to the number of persons employed by it for libraries serving different sizes of population. Each dot represents the ratio for a given year for all libraries serving cities in one of the three population groupings.

It will be noted that the dots cluster rather closely about the straight line drawn through the origin. This means that the ratio of labor to number of books remains

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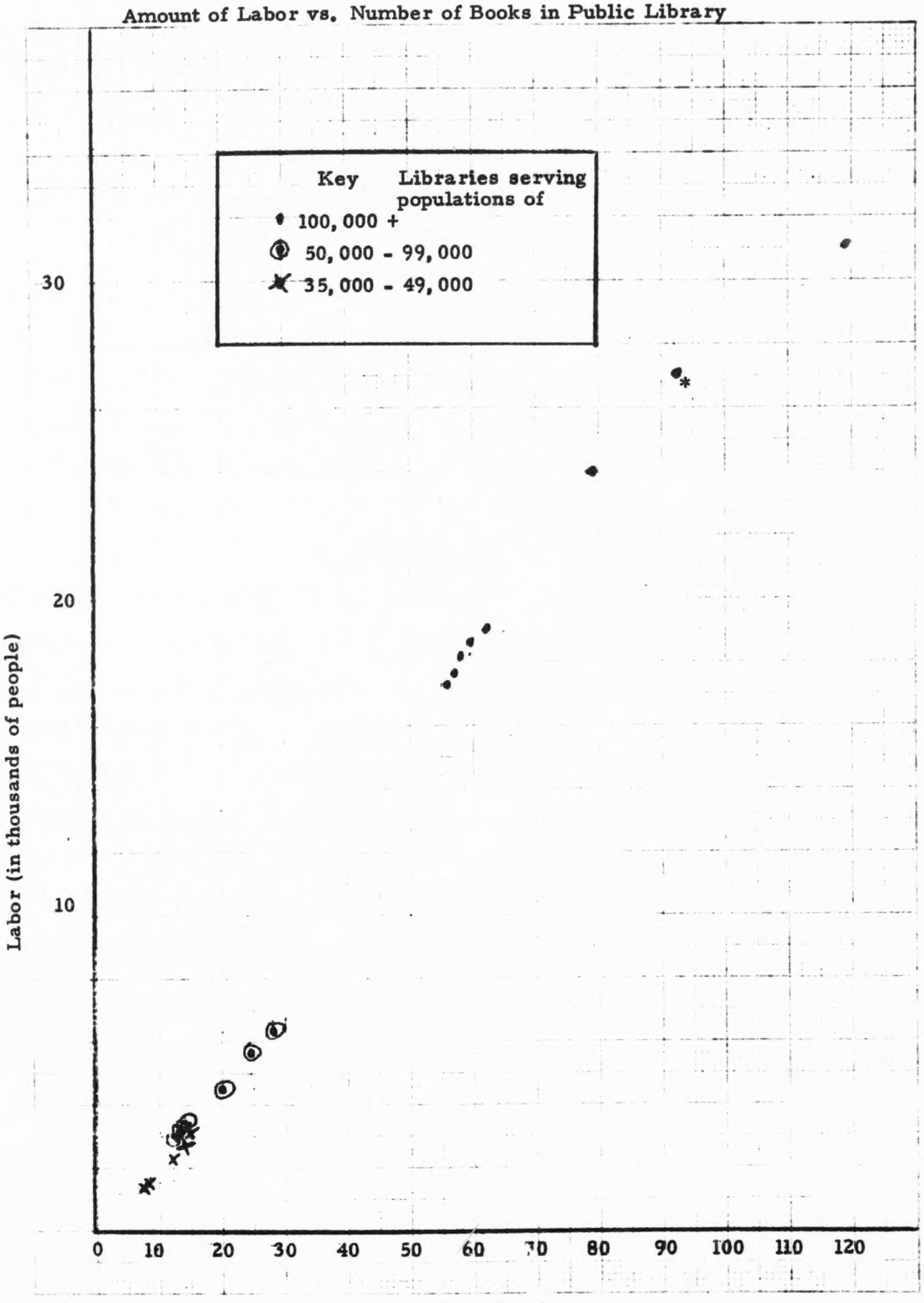
[37] The data source is the same as for Figures 22 and 23 above.

Figure 24

Amount of Labor vs. Number of Books in Public Library



Source: See footnote 36.

* change in sample

virtually fixed as libraries grow through time. It is possible that the effects of the use of computers in facilitating the work of the circulation desk and other time consuming areas of operation may substantially reduce the labor component in the operation of larger libraries because only the large institutions could afford to make full use of the expensive equipment required. However, as yet no significant change in the relative book/labor ratio seems to have occurred. There seems to be a slight curvature in the relationship for libraries serving populations of 100,000 and over, indicating some slight labor saving in that range (books increase more than in proportion to labor) but this may also simply reflect a change in the composition of the sample that occurred in 1959. Thus, we see that by and large with current technology a doubling in the number of volumes carried by a library requires a doubling in the labor time required for its operation. This does not contradict the finding reported in the preceding section to the effect that there are economies of large scale in the operation of libraries. It means rather that these economies are achieved in larger libraries by more effective utilization of both books and labor. In larger libraries circulation per volume and circulation per labor hour would then both have to be greater in the large library, with no significant change in their ratio.

3. Rising Costs, Personnel Shortages and Automation

So far we have dealt with sheer scale of operation as a possible instrument of economy. In addition, one must consider the specific proposals for technological innovation in terms of their economic implications. Unfortunately, experience with most of these is extremely limited so that they can only be dealt with descriptively because there are virtually no data permitting a reliable evaluation of their effects on library costs let alone their consequences for the quality of library operations.

There is much that is inherently attractive about what might be described as handicraft modes of library operation. An open shelf library through which the reader can browse can be of enormous help to the scholar and is pleasant for everyone. A microfilm is efficient to store and offers other advantages, but in many respects it is an imperfect substitute for a book. We have already discussed the importance of the librarian behind the desk with whom one can discuss the sources one needs and who can expedite the users' request for them.

It is only natural, therefore, for everyone concerned to resist the innovations which threaten this state of affairs. Yet many libraries have long given up any attempt to operate on an open shelf basis. Volumes that are infrequently used are sometimes stored where they can be obtained only after some delay, and many items are available only on microfilm. These innovations have met with relatively little opposition because they have not affected seriously the overall atmosphere of library operations. Some of the more Orwellian visions of what may be entailed by library automation may well give one pause. Pictures of volumes being available only on television screens where they are flashed in response to a volume identification code transmitted through push buttons may or may not be attractive depending on one's point of view. Obviously, automation can take far less drastic forms and encompass far less vital portions of a library's operations. For example, only routine and uninteresting labor would be replaced by an electronic device which scanned one's library card when returning a volume and automatically reported any fine that was due. The authors of this report can pretend to no expertise in library operation and therefore would not presume to judge the specific innovations that are possible. Our point is merely that their effects on the library would certainly not all be equally drastic.

What has all this to do with the anticipated shortage of librarians and the prospective increases in library costs? The relationship to the former is fairly obvious. If the number of librarians in prospect is inadequate, then something must be done to supplement their labor. In the more routine tasks of library operation the efforts of skilled individuals simply will have to be replaced either by the use of personnel less adequate in their training, or by the use of technical devices--the equipment of automation. The object is, of course, to make most effective use of such skilled persons as will be available. Hence, one must avoid, at all costs, a uniform reduction in their utilization in the various portions of a library 's activity. Rather, their efforts should be transferred increasingly from the more routine and less demanding parts of the library's operations to those portions of its work in which specialized personnel would be missed most severely. If, for example, one can routinize totally the borrowing and return of books by means of an automatic electronic device that senses both an identifying card for the borrower and another for the volume, the resulting reduction in labor should not decrease the usefulness of the library to the borrower. Similarly, if a standard and uniform cataloguing procedure could be agreed upon , with a set of cards (including, perhaps, standardized descriptive computer punched cards) and other requisite materials supplied by the publisher along with the book, a substantial reduction in labor time at the library might be effected. Indeed, in this case the change might perhaps even constitute an improvement in service. For if authors were, as a matter of course, to supply a standardized description of their works on which card or computer cataloguing could be based, then the danger of misclassification might be reduced significantly, particularly in the case of works in more specialized and technical areas. Automation is then an appropriate, indeed an unavoidable response to a shortage of librarians. However, its introduction requires a great deal of thought and analysis of the nature of library operations in order to plan the use of automated equipment in a way which minimizes any resulting reduction in the quality of library services. Though such a desideratum smacks of the platitudinous, it is, in fact, a very serious matter, for in the absence of such planning it is likely that the course of technological development will simply follow the line of least resistance--the design of new equipment will be ordered in accord with the ease with which the technical problems can be solved, and as the shortage of skilled personnel becomes more acute, libraries will be forced willy-nilly to adopt the labor saving equipment that happens to be available, without regard to its consequences for quality of service. Only early study of these matters can provide the designers of library equipment with adequate guidelines to the libraries' needs, and can thereby avoid forced utilization of devices which meet only very inadequately the needs of effective service.

The rising costs of library service are also highly relevant for the issue of automation. As has been seen earlier, a critical component in the cost problem is the high labor content of library operation and the difficulty besetting reduction in utilization of this input. Since an inability to decrease the use of labor per unit of output is tantamount to failure to increase productivity, the unit costs of library service must increase constantly in relation to those of the remainder of the economy in which rising productivity is commonplace.

Automation may well constitute an effective means to deal with this problem. While it may not eliminate the difficulty, it may render it far less critical. Even if the costs of the equipment are such that its immediate cost advantage is not very great, its long run contribution to the library's cost problem may well be substantial. For any activity, once it has been taken over by the machines, loses its characterization as a personal service. Consequently, its labor content is no longer correlated directly with the quality of its output. Thereafter it becomes eligible for exactly the same sorts of increase in efficiency and increases in productivity as those from which the remainder of the economy constantly benefits. Thus every library suboperation that can be automated becomes one less contributor to the fundamental long run cost problem of the libraries-- the continuous and cumulative rises in costs which inevitably characterize the supply of every personnel service output.

These, then, are two compelling grounds for the libraries to undertake the utilization of mechanical and electronic substitutes for human effort, wherever it can be done without substantial reduction in quality of service. The assertion that current quality of output is as good as that which the machines can provide is not an effective answer, for, in the long run, unless one takes advantage of opportunities to reduce the utilization of labor, shortages of trained librarians and cumulative rises in cost may well cause a very serious deterioration in service that earlier planning and greater flexibility in mode of operation might have been able to avoid.

4. When Does a Piece of Equipment Become Economical?

As a piece of electronic library equipment or some other instrument of automation becomes relatively less expensive there is likely to come a point where its introduction becomes economical for some particular library. However, to those who have not specialized in this type of decision it may not be entirely clear how one determines when that point has been reached. Suppose a piece of equipment costs a $100 thousand and that it can be used to do the work of three employees whose combined annual income is $20 thousand. Is the purchase of the machine a cost saving decision? The two figures by themselves do not provide the answer, for the long-term capital expenditure of $100 thousand on the machine is not directly comparable with an outlay of $20 thousand *per annum*. It would, for example, be wrong to estimate that the machine is expected to last six years and is therefore economic because it saves $120 thousand in salary payments. Such a crude comparison makes no allowance for the uncertainty about the expected future life of the machine, which might unexpectedly break down or be rendered obsolete by a new invention before the six year period is over. It also makes no provision for inconvenience caused by the tying up of so much money in the machine, funds which the library might otherwise have put to good use.

Rather sophisticated methods of calculation have been devised to deal with this sort of decision, methods that are described in books dealing with capital budgeting.[38]

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[38] For a brief but somewhat mathematical discussion see W. J. Baumol, Economic Theory and Operations Analysis, Prentice-Hall, Englewood Cliffs, New Jersey, 2nd ed., 1965, Chapter 18, Section 9, 11 and Chapter 19, Sections 2-8.

However, for those who have neither the time nor the inclination to go into this matter in detail there is available a direct and simple approach to the matter. Most computers and many other pieces of equipment are available on a rental basis. Whether the library considering the the item wishes to rent or buy the item is not the issue. The point is that the annual rental cost of a machine is (if calculated correctly by its supplier) the annual equivalent of the item's total value. It is this annual rent which should, therefore, be compared with the potential saving promised by the item. If the machine described in our previous illustration rents for $15 thousand per annum its purchase would represent a net saving to the library because it avoids the annual outlay of $20 thousand in salaries. On the other hand, if the annual rental were $30 thousand, the machine would represent no net financial gain (though it might perhaps still be worth purchasing on other grounds --if it represented a net addition to the services of the library valued at more than the $10 thousand net increase in expenditures it incurred).

5. Alternative Instruments of Automation: Improved Service

As yet the employment of automation by the libraries has been relatively limited. A number of experiments involving particular portions of library operation have been reported and apparently, only in a very few cases is a really major modification in operations even imminent.[39]

Some of the discussion, on the other hand, has been far less conservative. For example, some degree of attention has been attracted by the systems approach in which the entire library operation is viewed as a sequential process, and is subjected throughout to the ministrations of the computer. In the words of William Dix

> It seems possible to have the computer play a major role in the entire process of adding a book to the collections, from the moment a decision is made to acquire the book until the book is on the shelf and the bibliographic record fully available in the on-line computer store. From the beginning of the process with the search to make sure that the book is not already in the library, a record can be fed into the computer and, taking advantage of the efficiency of the computer in accepting additions and revisions, this record can be perfected progressively. During this process the computer can prepare the order for the dealer, check on outstanding orders, keep the rather complex financial records, accumulate and organize the various elements of descriptive and subject cataloguing and classification, prepare book labels and book cards, and produce various cards and lists as required, such as

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[39] For an illuminating survey by a visitor from abroad see Harrison Brian, "American Automation in Action," Library Journal, January 15, 1967. The article includes a brief discussion of the Florida Atlantic Experiment, the case where automation seems to have gone as far as it has anywhere, and discusses the plans and experiences of a considerable number of other institutions.

> selective lists of new acquisitions. This enumeration is by no means complete.
>
> The computer cannot perform the intellectual operations of cataloguing. It can, however, do a great many file-keeping and clerical operations for which it is increasingly difficult in all libraries to find competent personnel. It can do some of these internal library operations better than they are now being done. No one seems prepared at this time to say with certainty that the computer will perform these operations more inexpensively than they are now being done.
>
> It should be emphasized at this point that no large university library has a computer-based system of the sort which I have sketchily outlined now in full operation. Various elements of it are being tried on an experimental basis in individual libraries.[40]

The authors of this report have no special competence for a detailed examination of the technology and its potential areas of application. Yet economics does provide the basis for a number of observations which may prove helpful to those involved in planning and decision making in the area. The following discussion is intended to confine itself to such materials. It is convenient for this purpose to divide the proposed innovations into two categories: those which promise reductions in cost and those which offer improvements in the quality of library service. However, it should be recognized that the distinction between the two classes is somewhat artificial. A modification in technology that makes possible a *ceteris paribus* increase in service, by definition will also normally permit a decrease in cost that requires no commensurate reduction in the quality of service provided. For example, a procedure which reduces the cost per circulation by 20 per cent would permit either a 20 per cent increase in level of operation without any expansion in outlays, or, alternatively, a 20 per cent reduction in the level of service.

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[40] William S. Dix, " Annual Report of the Librarian, Year ending June 30, 1966," Princeton University Library (mimeographed), reissued with minor revisions, November 1966. This report contains a very valuable survey and evaluation of the various aspects of automation in the library.

Nevertheless, it is possible to list a number of proposed innovations, particularly those involving the use of computers, whose primary rationale is not reduction in cost but an improvement in the usefulness of library operations.

One promising application of computers of this variety is their use in interlibrary loans, though this is probably a development for the very distant future. If it becomes practicable to store a library's catalogue information in some sort of computer memory, the linkages among the computers employed by different libraries could be utilized to determine quickly where some particular item is to be found.

The computers could then automatically forward the request for the inter-library loan, provide the requisite records and handle all the other relevant details with no delay except that involved in the physical transportation of the requested volume.

The most characteristic of the types of innovation whose primary purpose is to increase quality of operation is the use of computers to find pertinent references in a particular area of research. Here a determined effort is under way to find methods to replace not relatively unskilled labor, but to obtain substitutes for the efforts of the most highly skilled librarians.

Ideally, computer memories would be asked to store information on a vast variety of subjects each of which would be characterized by a limited number of key phrases. The scholar searching for references in some particular area could simply punch out the key words that describe his area of interest and the computer's memory storage would then regurgitate everything which appeared to be pertinent. If such a system were put into operation it might be hoped that the computer would be more effective in helping the scholar in his researches than anyone but the most highly skilled and specialized librarian.

Unfortunately, the facts suggest that such a goal may never be achieved, or if it is, it will be very long time in coming. In essence, electronic computers are not the giant intelligences which the literature of science fiction sometime alleges them to be. Rather, they are more felicitously characterized as extremely quick idiots capable of doing no more than is required by the instructions that have been fed to them in excruciating detail. As a result, computer compilations of reference materials are likely to include the products of serious misunderstanding of what happens to be required. Just as computer produced translations are hopelessly literal and lacking in insight, the programmed response to a scholar's request for information in any particular field is likely to produce large amounts of redundancy resulting from misunderstanding of alternative denotations of words and phrases utilized in the instructions. Moreover, the computer's response may well omit some crucial references simply because it is incapable of grasping the overtones of the information request.

These comments are not meant to imply that computers cannot supply effective assistance to the work of the scholar. On the contrary, the evidence suggests overwhelmingly that it has already done so. What the observations mean is that the computer constitutes no real threat of technological unemployment for the skilled librarian. Rather, these specialized personnel may in the future require even more training and a higher level of specialization as the sophistication and complexity of library technology increase. They may have to learn not only how to communicate with the electronic computer, but, in addition they will have to understand fully the nature of its limitations and the ways in which one can compensate for them.

In short, where the new technology undertakes to provide service relating to the most demanding requirements of library users it cannot be expected to yield any significant reduction in costs. It may perhaps render the library an instrument of research that is even more useful than it is today. But this is apt to call for even more effort and training on the part of skilled librarians than has been provided in the past.

6. Cost Saving Innovations

As has often proved true elsewhere in the economy, if innovations are really to make possible significant reductions in cost, their primary focus should be the relatively unskilled operations of the library rather than those calling for the highest levels of specialization and training. Thus they would relate to comparatively routine operations such as the recording of a loan, or even the cataloguing of a newly acquired book rather than the search for the reference imperfectly identified by a scholar. An activity that requires no specialized training is by that very fact a prime candidate for mechanization.

Spotty evidence suggests that even those innovations which fall under this heading are by and large uneconomic for the moment. Electronic equipment in general and computer time together with the preparation of the pertinent "software" (the required auxiliary instructions) are still usually more expensive than the corresponding human effort. But, as has already been indicated, this relationship is not likely to continue indefinitely. In real terms, the computer effort may be expected to become relatively cheaper and the human effort more expensive, so that planning based upon reasonable expectations must prepare for the substitution of equipment for comparatively unskilled labor wherever this seems like a reasonable possibility.

From the point of view of the outsider who is not aware of their nuances the most routine portions of library activity proper include checkout operations, calculation and billing of fines, shelving of returned volumes and at least some aspects of cataloguing. In addition, library operations include a variety of routine activities which are not peculiarly related to their area of specialization--budgeting, accounting, building maintenance, etc.

Part VI. Concluding Comment

This study has examined in considerable detail a number of aspects of the economic structure of the library. It has made no attempt to provide an exhaustive survey of all phases of library activity but has sought to focus instead on those matters relating to important current and prospective policy issues. Our data have related almost exclusively to two important classes of libraries: the public libraries and the college and university libraries. Our discussion was confined to these institutions simply because virtually no information was available about other classes of libraries--indeed the data for the types of institution which we did examine proved extremely difficult to acquire.

Nevertheless, we were able to investigate a considerable variety of economic issues, among them considerations relating to automation, the role of economies of scale, the prospects for funding from various sources, the compensation of librarians and, above all, the nature of library costs. The last of these topics was examined in some detail and provided the subject of a more extensive analysis. It was shown that in the nature of library technology as it is currently constituted, cumulatively rising relative costs per unit of service are an unavoidable consequence. To some extent this can be offset in the long run by automation. But it means also that those who provide financial support to the libraries, the governments, the institutions and the individuals, must learn that this entails a dynamic responsibility--that as the wealth of the economy grows, the financial needs of the libraries will unavoidably also increase; unless this is generally recognized and understood the nation's libraries are likely to find themselves plagued by financial pressures which might well have been avoided.

Appendix A

An Economic Model of Library Operation

1. Introduction

In recent years economic decisions have made increasing use of mathematical models describing the structure of the problem at issue. With the aid of such models it often becomes possible to determine, to some reasonable degree of approximation, the optimal decision, i. e., the best of the alternatives available to the decision maker. At least one such model relating to the operation of the libraries has already appeared in the literature.[41] This represented an engineering approach dealing with such particular issues as the average rate of decline in a book's annual circulation as a function of its age and the relation to spatial dispersion of library resources. This appendix deals with some broader issues relating to the overall operation of the library and some of the variables that affect it. In Appendix B, the conclusion of the discussion of the model itself, there are presented some empirical findings which have been derived with its aid.

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[41] See F. F. Leimkuhler, " Systems Analysis in University Libraries, " College and Research Libraries, January, 1966, pp. 13-18.

The purpose of this paper is describe briefly and analyze the short-run and long-run characteristics of a simple model of a library. Definitions will be made in such a way that the model can be interpreted as applying either to a public library, a school library, or a college or university library, although the structural parameters will presumably be quite different for these different types of libraries.

The library, regardless of type, is conceived as primarily a producer of " circulation," defined broadly to include in-library use of reference facilities, microfilm, etc. The revenues available to the library are spent on a combination of skilled labor services, purchase of ancillary processing equipment, and the maintenance and expansion of a stock of "books," again defined broadly to include periodicals and microfilm in this simple model.

The librarian chooses the division of his revenues between expenditures on wages and salaries, books and other library materials, and purchase of ancillary equipment in such a way as to maximize circulation subject to the revenue constraint. The analysis produces a supply of circulation function and a shadow price variable which represents the implicit cost of borrowing a book. This cost is essentially the reciprocal of the marginal increase in circulation from an extra dollar of revenue.

A demand for circulation function is also introduced, making demand a function of population served (or number of students served if a school), income per-capita (or total school revenue per student if a school), and the implicit cost of poorer service, faster recall of books, and smaller chance of finding a desired book which result from a lower amount of revenue.

Equating demand to supply, we find the equilibrium implicit cost of borrowing, the revenue which the library must receive to provide the equilibrium level of services, and the equilibrium levels of circulation, labor services, rate of book purchase, and rate of purchase of ancillary equipment. Each of these solutions is in terms of the structural parameters of the model and the exogenous variables: population, income per-capita, wage rate, and book price.

Next it is assumed that each of these exogenous variables grows at some specified constant rate (differing for each variable). Steady growth solutions are then obtained for the rates of growth of revenue, circulation, book stock, and labor input.

The model could be extended to deal with the existence of a constraint on storage space, obsolescence of books, and technical progress in library operation.

With perfect data available, it would be possible to estimate both the parameters of the model and the rate of growth of the exogenous variables. In fact, it appears that some data on the rates of growth are available, but that assumptions may be required for at least some of the parameters of the model.

2. The Economic Model

The library is assumed to be able to produce a maximum circulation (C_t) per time period with a given stock of books (B_t), input of labor services (L_t) and processing equipment (V_t). The particular form of the circulation function specifies diminishing marginal productivity to additional amounts of any one input, holding other inputs constant. Increasing returns to scale are expected.

Specifically, our circulation function is taken to have the form

$$(1) \qquad C_t = A\, B_t^{\beta}\, L_t^{\lambda}\, V_t^{\theta} \quad .$$

Since only equilibrium growth is being studied here, demand will grow at a constant foreseen rate, and no excess capacity will be kept to satisfy fluctuations in demand. Books are assumed to depreciate at a constant percent δ per unit time, so that the average life of a book is $1/\delta$. The growth rate of the book stock (which is a variable in the growth part of the model) is assumed to be g. Thus the rate of book purchase per unit of time is $(g + \delta)\, B_t$, providing for both expansion and replacement. The percent rate of purchase of processing equipment is taken as ξ per unit time, so that purchases are ξV_t. The wage rate is w_t, book price q_t, equipment price s_t and total revenue is R_t. Thus the librarian's job is to maximize (1) subject to the constraint

$$(2) \qquad w_t L_t + q_t(g + \delta)\, B_t + s_t\, \xi V_t \leqq R_t$$

The maximization is accomplished with the aid of a Lagrange multiplier μ_t, which in the solution equals the partial derivative of C with respect to R. The optimal levels of B, L, and V for given R are

$$(3) \qquad B_t = \frac{\beta}{q_t(g+\delta)} \left(\frac{R_t}{\beta+\lambda+\theta}\right)$$

$$(4) \qquad L_t = \frac{\lambda}{w_t} \left(\frac{R_t}{\beta+\lambda+\theta}\right)$$

$$(5) \qquad V_t = \frac{\theta}{\xi \, s_t} \left(\frac{R_t}{\beta+\lambda+\theta}\right) \quad .$$

The supply of circulation as a function of R is given by substituting (3), (4), and (5) into (1) to get

$$(6) \quad C_t = A \left(\frac{R_t}{\lambda+\beta+\theta}\right)^{\lambda+\beta+\theta} \left(\frac{\beta}{q_t(g+s)}\right)^{\beta} \left(\frac{\lambda}{w_t}\right)^{\lambda} \left(\frac{\theta}{\xi \, s_t}\right)^{\theta}$$

In addition, the value of the Lagrange multiplier μ_t can be obtained from

$$(7) \qquad \frac{C_t}{\mu_t} = \frac{R_t}{\lambda+\beta+\theta} \quad .$$

Substituting (7) into (6), we obtain the supply of circulation as a function of $1/\mu_t$, which is interpreted as the implicit cost of borrowing a book:

$$(8) \quad C_t = A\left(\frac{1}{\mu_t}\right)^{\frac{1}{1-\lambda-\beta-\theta}} \left(\frac{\beta}{q_t(g+s)}\right)^{\frac{\beta}{1-\lambda-\beta-\theta}} \left(\frac{\lambda}{w_t}\right)^{\frac{\lambda}{1-\lambda-\beta-\theta}} \left(\frac{\theta}{\xi\ s_t}\right)^{\frac{\lambda}{1-\lambda-\beta-\theta}}$$

This interpretation can be obtained by noticing that $\partial C/\partial R$ in (6) is equal to μ_t as given in (7). Thus $1/\mu_t$ is the number of dollars it costs to supply an extra unit of circulation per time period.

a. Demand for Circulation It seems clear that the actual level of circulation produced by any library will depend on the interaction of supply conditions and available revenue with demand conditions, even though no market exists to ensure market clearing. It is assumed that higher demand relative to revenue is reflected partly in increased circulation and partly in a higher implicit cost of borrowing, i.e., through lower μ [see equation (7)]. This has the result of lowering demand through a price elasticity term. The demand function is assumed to be of the form

$$(9) \qquad C_t = A' P_t^{\epsilon}\, y_t^{\nu} \left(\frac{1}{\mu_t}\right)^{-\eta} ,$$

where P_t is population, y_t is income per captia. The effect of a higher implicit borrowing cost makes itself felt as longer waiting time to obtain a desired book, quicker recall, and other forms of reduced service.

b. *Equilibrium Solution* By equating (8) and (9) we can solve for the equilibrium implicit borrowing cost as a function of P, y, q, w and s. Substituting back into (9) we find the equilibrium level of circulation C. Then using (7) we determine the revenue per period required to provide the equilibrium amount of service. This solution turns out to be

$$(10)\quad R_t = (\lambda+\beta+\theta)\, P_t^{\frac{\epsilon}{1+\eta(1-\lambda-\beta-\theta)}}\, y_t^{\frac{\nu}{1+\eta(1-\lambda-\beta-\theta)}} \left(\frac{\beta}{q_t(g+s)}\right)^{\frac{\beta\eta}{1+\eta(1-\lambda-\beta-\theta)}} \left(\frac{\lambda}{w_t}\right)^{\frac{\lambda\eta}{1+\eta(1-\lambda-\beta-\theta)}} \left(\frac{\theta}{s_t\,\xi}\right)^{\frac{\theta\eta}{1+\eta(1-\eta)(1-\lambda-\beta-\theta)}}$$

c. *Equilibrium Growth* The relationship between the equilibrium rates of growth of endogenous variables and the exogenous variables is obtained by letting the exogenous variables grow at specified rates and substituting them into (1) to find the required rate of growth of R_t. This amounts to assuming that plans are formed and realized in such a way as to satisfy the equilibrium conditions in every time period along a path of equilibrium growth.

The assumed behavior of exogeneous variables is

$$P_t = P_o e^{\rho t} , \quad y_t = y_o e^{\gamma t} , \quad w_t = w_o e^{\omega t} ,$$

(11)

$$q_t = q_o e^{\kappa t} , \quad s_t = s_o e^{\sigma t}$$

The unknown behavior of endogenous variables which will be solved for will be described by

$$B_t = B_o e^{gt} , \quad C_t = C_o e^{ht} , \quad L_t = L_o e^{\ell t}$$

(12)

$$V_t = V_o e^{\xi t} , \quad R_t = R_o e^{rt} , \quad \frac{1}{\mu_t} = \frac{1}{\mu_o} e^{mt}$$

Inserting these definitions into (10) yields the rate of revenue growth

$$(13) \qquad r = \frac{\rho\epsilon + \gamma\nu - \kappa\beta\eta - \lambda\omega\eta - \theta\sigma\eta}{1 + \eta(1 - \lambda - \beta - \theta)}$$

Using (3), (4) and (5) we then find input growth rates

$$(14) \qquad g = r - \kappa , \quad \ell = r - \omega , \quad \xi = r - \sigma$$

Combining (14) with (1), we get the rate of growth of circulation

$$(15) \qquad h = \beta g + \lambda \ell + \theta \xi = (\beta + \lambda + \theta) r - \beta \kappa - \lambda \omega - \theta \sigma$$

By (7), the rate of growth of $1/\mu$, the implicit borrowing cost is

$$(16) \qquad m = r - h = \beta \kappa + \lambda \omega + \theta \sigma + (1 - \beta - \lambda - \theta) r$$

d. A Special Case By making a few additional strategic assumptions, the growth path solution we just obtained can be considerably simplified. Let us assume constant returns to scale in the circulation function (1), or $\lambda + \beta + \theta = 1$ and also that the elasticity of demand with respect to population is unity ($\epsilon = 1$). Then we can show that revenues grow at the rate

$$(17) \qquad r = \rho + \nu_{\gamma} + (1 - \eta)(\beta \kappa + \lambda \omega + \theta \sigma)$$

and the implicit cost of borrowing grows at rate

(18) $\qquad m = \beta \kappa + \lambda \omega + \theta \sigma$ so that (17) is the same as

(19) $$r = \rho + \nu\gamma + (1-\eta)\, m \ .$$

The rate of growth of circulation becomes

(20) $$h = \rho + \nu\gamma - \eta m \ .$$

Results (18) - (20) are exceedingly easy to interpret. The implicit cost of borrowing grows at a weighted average of the rates of increase of wages, and equipment costs. Revenues grow at the rate of population growth plus income elasticity times rate of per capita income growth plus one minus the price elasticity times the rate of growth of implicit cost of borrowing. Circulation grows at the rate of population growth plus income elasticity times per capita income growth less price elasticity times rate of growth of implicit borrowing cost.

Appendix B

Statistical Analysis of Library Cost and the Model of Appendix A

1. Operating Costs of Public Libraries

This section offers an interpretation of public library data in terms of the economic model of libraries described in Appendix A. The data considered here concern libraries in cities of size 50 to 100 thousand and 100 thousand and over, from 1954 to 1959. We are interested in the relation of circulation to the input of books and personnel. Operating costs consist mainly of salary costs and book purchase costs. These costs are related to circulation through the shadow price concept of the implicit cost of borrowing , which has previously been shown to represent the marginal cost of circulating an extra volume, on an equilibrium growth path.

From 1954 to 1959, the average annual rate of increase of ciruclation in libraries serving populations of 50,000 and over has been 5 per cent per year. Over the same period the book stock of these libraries has grown an average of 2.8 per cent per year. Library staff has increased only 2.6 per cent per year. These figures clearly imply either substantial increasing returns to scale or technological progress which allows a given circulation figure to be supported with less inputs of books and manpower.

Total operating expenditures rose nearly 7 per cent a year over the 54-59 period, just matching the growth in personal income generated by a 5.1 per cent increase in per capita disposable income and a 1.9 per cent a year rise in population. Expenditures have grown this rapidly because of a 3-1/2 per cent to 4 per cent rate of increase in book prices and salaries, with salaries perhaps rising a bit faster than book prices. These price and wage increases, when combined with the increases in book stock and labor input cited earlier, accounted for most of the 7 per cent of increase in expenditures.

The rate of increase of the implicit cost of borrowing a book was 2 per cent a year over the period. This is equivalent to the rate of increase of expenditures per unit of circulation, which is the rate of increase of expenditures (7 per cent) less the rate of growth of circulation (5 per cent).

On the basis of the 7 per cent of total expenditures and the 3-1/2 per cent to 4 per cent rate of growth of costs

Table 1

Regression Results-Public Libraries Serving Cities of Size 35-50,000; 50-100,000;100,000 and over-1964-1962

$$(1) \quad \log C = \underset{(1.15)}{10.0} + \underset{(.24)}{.027 D_1} - \underset{(.58)}{7.11 D_2} + \underset{(.13)}{.955 \log L}$$

$$R^2 = .91 \, , \; F_{3,16} = 55.7$$

$$(2) \quad \log C = \underset{(2.69)}{-1.35} - \underset{(.24)}{.100 D_1} - \underset{(.60)}{7.31 D_2} + \underset{(.16)}{1.16 \log B}$$

$$R^2 = .91 \, , \; F_{3,16} = 55.4$$

$$(3) \quad \log C = \underset{(43.07)}{10.56} + \underset{(.54)}{.034 D_1} - \underset{(.97)}{-7.10 D_2} + \underset{(3.61)}{1.008 \log L} - \underset{(4.39)}{.066 \log B}$$

$$R^2 = .91 \, , \; F_{4,15} = 39.1$$

Correlation Matrix

	C	D_1	D_2	L	B
C	1.00				
D_1	-.21	1.00			
D_2	-.78	.25	1.00		
L	.23	.06	.36	1.00	
B	.17	.13	.41	.99	1.00

C = Circulation

D_1= Dummy for 59, 60, and 62 for change in sample and addition of county and regional libraries.

D_2= Dummy for 62 for cities of 100,000 and over to allow for inclusion of N. Y. Reference Library.

L = Library staff

B = Book stock

per unit of input, one would expect on a straight Cobb-Douglas model of circulation to have inputs increasing at above 3 per cent a year (see equations (3) and (14) of the library model). If, however, embodied technological progress is taking place, this would reduce the expected rate of growth of physical inputs as long as the rate of growth of effective labor input or book stock exceeds 3 per cent.

2. Returns to Scale

Several attempts have been made to estimate the parameters of the assumed " circulation function"

$$C_{it} = A\ B_{it}^{\beta}\ L_{it}^{\lambda} \quad \text{or} \quad \log C_{it} = \log A + \beta \log B_{it} + \lambda \log L_{it}$$

between circulation (C) and inputs of labor (L) and book stock (B). The subscripts on C_{it} refer to circulation in year t of libraries serving populations of size i. The survey data collected by the U. S. Office of Education cover the years 1954 to 1962 and libraries serving cities of size 35,000 to 50,000; 50,000 to 100,000; and 100,000 and over, for a total of 20 observations. Table 1 below summarizes the results of these efforts.

Equation (3) in Table 1 is the logarithmic form of the circulation function above with dummy variables added to reflect two serious changes in definition of the sample. Although the overall fit of the equation as measured by R^2 of .91 is very good, the coefficients of the chief variables of interest, labor input (L) and book stock (B), do not appear to be significantly different from zero. This is indicated by the size of the coefficients being less than their respective standard errors, shown in parentheses below the coefficients. The statistical reason for this result is a high degree of multicollinearity indicated by the correlation of .99 between the two explanatory variables L and B.

The true implications of equation (3) are revealed by dropping either of the two closely related explanatory variables, as is done in equations (1) and (2). Here we find the same overall fit as measured by R^2 and coefficients for either B or L which are over seven times their respective standard errors.

The question which then arises is how are we to interpret these results? It turns out that the correlation of .99 between B and L can be expressed approximately as

$$L = (.2265 \times 10^{-3})B \text{ or } \log L = \log(.2265 \times 10^{-3}) + \log B.$$

Substituting the latter equation into equation (3) gives

$$\log C = \text{constant} + \text{dummies} + (1.008 - .066) \log L,$$

so that $1.008 - .066 = .942$ is an estimate of the sum of the coefficients $\beta + \lambda$. This is the same sort of result as obtained by assuming $\log L = \text{constant} + \log B$ to begin with and substituting into the logarithmic form of the circulation function to derive as estimating equation such as (1) or (2). In all three equations we are estimating the sum of the coefficients $\beta + \lambda$. And in all three cases we come out with point estimates that are not significantly different from unity. Thus the hypothesis of constant returns to scale cannot be rejected.

Having failed to estimate the coefficients β and λ from the regressions above, our next step is to use the cost minimization equations from the library model to estimate their ratio. This ratio, together with knowledge that the sum of the coefficients is approximately unity, can be used to determine point estimates of the coefficients themselves.

The ratio of the equations minimizing cost with respect to book purchases and labor input is

$$\frac{\beta}{\lambda} = \frac{qB}{wL} = \frac{\text{book purchase costs}}{\text{wage and salary costs}}$$

For the public library data, the overall average ratio of book purchase costs to wage and salary costs is .216. The average ratio for libraries serving populations of size 100,000 and over is .177, while the averages for size 50,000 to 100,000 and 35,000 to 50,000 were .235 and .261, respectively. There appears to be a clear tendency for books to become more important relative to labor as size decreases. From these data, it is inferred that the ratio $\beta/\lambda = .2$, approximately. This together with $\beta + \lambda = 1$ implies $\beta = .167$, $\lambda = .833$.

3. Technical Progress

These estimates can be used to provide a residual estimate of the impact of technical improvements and other factors influencing the efficiency of library service. Let us modify the circulation function to allow for neutral technical change of 100 u per cent per year, or

$$C_t = Ae^{ut}B_t^{.167}L_t^{.833}.$$

This implies

$$\log \frac{C_t}{B_t} = \log A + ut + .833 \log \frac{L_t}{B_t} .$$

Now the data show staff per volume owned, L/B, roughly constant from 1954 to 1959 for libraries serving cities of size 50,000 and over. Over the same period circulation per volume owned rose at an average annual rate of 2 per cent per year. Thus it appears that $u = .02$ for this period, at least. A 2 per cent per year rate of " technical progress" may appear a bit high for public libraries, especially since new techniques must often be embodied in new machines or new personnel who are familiar with the new methods. As a check, another set of assumptions which are not inconsistent with the data imply $\beta + \lambda = 1.2$, $\beta = .2$, $\lambda = 1$, $u = .014$. Thus increasing returns to scale reduce the estimated rate of technical progress to about 1-1/2 per cent per year.

4. The Demand Function

It has not been possible to estimate the parameters of the demand function (9) but it is possible that the income and price elasticities both equal unity, on the likely hypothesis that the population elasticity is equal to one. For then the rate of growth of circulation per capita, at 3 per cent, should equal the income elasticity times 5 per cent less the price elasticity times the 2 per cent rate of increase in the implicit cost of borrowing.

An exceedingly shaky projection might be built on this analysis. A reasonable projection of personal income by the Commerce Department suggests that if the unemployment rate is 3-1/2 per cent in 1975, personal income per capita will grow an average of 4-1/2 per cent a year from 1965 to 1975. The Census Bureau's B-Series population projection shows 1.4 per cent a year growth over this period. A continued 2 per cent increase in unit costs of circulation (i.e., implicit cost of borrowing) together with unitary price and income elasticities would imply a 4 per cent rate of growth of circulation, 6 per cent growth in expenditures, and only 1-3/4 per cent rates growth of book stock and labor input. This of course ignores backlogs of unmet needs and considers only equilibrium growth at a given level of service. Notice that expenditures are projected to grow at the same rate as total personal income , 6 per cent.

Alternative elasticity assumptions that are also consistent with the 1954-59 record are an income elasticity of 1.2 together with a price elasticity of 1.5 or an income elasticity of .8 and price elasticity of .5. The first of these alternative assumptions yields a forecast for rate of circulation growth of 3.8 per cent per year from 1965 to 1975. The second yields a projection of 4 per cent a year circulation growth. Thus the projection is not too sensitive to the choice of parameters, but rather reflect the slower projected rate of growth of population and per capita income.

The implication of these projections appears to be roughly equal rates of growth of personal (and national) income and library expenditures. Given the tax structure, libraries will probably be able to maintain their share of growing income. These conclusions, however, are based on rather shaky data for a relatively short time period.

Appendix C

Design of the College and University Library Sample and other Data Specifications

As already noted our usable data consisted exclusively of figures relating to public libraries and to college and university libraries. The latter were themselves composed of two series, one, for the years 1960-66, relating to colleges and universities as a whole, and a second, longer series constructed by us from a substantial sample of libraries.

The public library data (for cities with a population of 50,000 or more) were obtained from the following two series of pamphlets:

U. S. Department of Health, Education and Welfare, Office of Education, Statistics of Public Library Systems in Cities with Populations of 100,000 or more, and a similar series... In Cities with Populations of 50,000 to 99,999.

Though there are some data in these fiscal series, from fiscal 1945 through to fiscal 1962, 1954 to fiscal 1959 inclusive were chosen as the basis for this study since

(a) There were changes in sample size after 1959 (to include county and regional libraries and the New York Reference Library).

(b) The data for periods preceding 1954 were later "updated" to make them comparable to the post 54 data.

(c) The first substantial data available for both population breakdowns were for fiscal 1954 (for the smaller population categories comparable data are not present until even later years).

The figures for total all college and university libraries appear in the American Library Association, _Library Statistics of Colleges and Universities, 1965-66, Institutional Data,_ 1967, pp. 6-9. These data (for 1959-60 to 1964-65) were compiled by Theodore Samore for U. S. Office of Education, _Library Statistics of Colleges and Universities. Institutional Data._

The sample of colleges and universities was chosen[42] in accord with statistical principles designed to assure a representative and relatively reliable breakdown of expenditure figures. Thus large institutions are sampled heavily to minimize sampling error arising from the large variance in expenditure breakdowns between institutions. Liberal arts colleges were sampled heavily because of their large numbers. The sample size chosen was 100 institutions reporting to the Association of College and Research Libraries, from which data were obtained for the 9 years from 1950 to 1959. An additional five years was added from the Federal Government and A. C. R. L. publications from 1960 to 1966 (excluding 1965).

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[42] The college and university library sample for the fiscal years 1951 to 1959 was taken from a series of statistical studies conducted by the statistics committee of the Association of College and Research Libraries of the American Library Association and published annually in the January issues of the College and Research Libraries.

The data for the years , 1959-60 to 1964-65 were derived from a series of annual surveys, U. S. Department of Health, Education, and Welfare, Office of Education Library Statistics of Colleges and Universities, Part 1, Institutional Data.

The data for 1966 were obtained from the continuation of this series by the American Library Association, Library Statistics of Colleges and Universities, 1965-66, Institutional Data, 1967.

Table 2

Construction of Sample

Type of School	No. of Schools in 1960 Universe	Approx. % of Total No.	1960 Mean Oper. Expend.	Sample Proportion
University	150	10	680	42
College	760	47	160	47
Teachers College	195	12	83	6
Technical Inst.	53			
Junior College	526	31	25	5
		100		100

The proportions in the last column of Table 2 were chosen on the basis of the relative size of libraries shown in column 3 and their relative numerical importance given in column 2. This was done on the grounds that the standard deviation of operating expenditures is likely to be proportional to the size of institution.

The actual institutions sampled were chosen with the aid of number table from the 1950 list of schools reporting to the A. C. R. L. Replacements were chosen for schools which dropped out of the sample. Since the sample size varies between about 75 and 100 because of reporting variations, no meaningful total figures can be derived from the sample. It is thought, however, that for the aggregate of colleges and universities the sample will give useful information on the breakdown of expenditures, expenditures per student, and expenditures per unit of input.

As a quick check on the accuracy of our sample of colleges and universities, we compared our results for 1960 to 1966 (on a per unit input basis) to those of the American Library Association. The ALA, during these same years, published not only institutional but aggregate data for all college and univeristy libraries in continental and outlying U.S.A. This comparison gave us further confidence in our results, as the following table will illustrate.

(Appendix C)

TABLE 3

Comparison of Sample of 100 Colleges and Universities

vs

Total All Colleges and Universities

	1960		1961		1962	
	Sample of 100	Total All	Sample of 100	Total All	Sample of 100	Total All
Total Exp./vol. owned	.752	.777	.864	.840	.872	.913
Exp. for Salary & Wages per vol. owned[2]	.473	.476	.498	.516	.532	.553
Exp. for Books & material per vol. owned [2]	.203	.231	.244	.256	.254	.280

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[2] For our sample of 100 college and university libraries:
Exp. for salaries and wages includes staff salaries and student salaries.
Exp. for books & material covers only books.

TABLE 3 (Continued)

	1963		1964		1965	1966	
	Sample of 100	Total All	Sample of 100	Total All	Total All	Sample of 100	Total All
Total Exp./vol. owned	.937	.991	1.031	1.084	1.141	1.225	1.208
Exp. for Salary & Wages per vol. owned[2]	.563	.605	.603	.639	.660	.705	.674
Exp. for Books & material per vol. owned[2]	.288	.302	.309	.348	.378	.387	.419